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National Commission on Technology, Automation and Economic Progress, Washington, D.C.

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Forty-seven statements by industrial and business spokesmen, union and association representatives, and professors concern the broad impact of technological change on individuals, establishments, and society in general. Some of the longer presentations are (1) "The Poverty and Unemployment Crisis," by Walter Buckingham, (2) "Technological Change--Past and Present," by Clyde E. Dankert, (3) "Automation--Its Impact on Employment and Unemployment," by the General Electric Company, (4) "Automation--A Position Paper," by the International Chemical Workers Union, (5) "Role and Pace of Technological Change," by the Metropolitan Life Insurance Company, (6) "The Impact of Automation on American Unionism and Its Possible Consequences," by Julius Rezler, and (7) "Automation--Promise and Problems," by the United Mine Workers of America. Other appendixes to VT 003 962 are VT 003 960, VT 003 961, and VT 005 794-VT 005 797. (EM)

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STATEMENTS RELATING TO THE IMPACT OF TECHNOLOGICAL CHANGE

Appendix Volume VI

TECHNOLOGY AND THE AMERICAN ECONOMY,

The Report of the Commission

Prepared for the National Commission on Technology, Automation, and Economic Progress • February 1966

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STATEMENTS RELATING TO THE IMPACT OF TECHNOLOGICAL CHANGE

Appendix Volume VI
TECHNOLOGY AND THE AMERICAN ECONOMY,
The Report of the Commission

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PREFACE

This is the sixth of six appendix volumes of Technology and the American Economy, the report of the National Commission on Technology, Automation, and Economic Progress. The full series of appendix volumes is as follows:

I. The Outlook for Technological Change
II. The Employment Impact of Technological Change
III. Adjusting to Change
IV. Educational Implications of Technological Change
V. Applying Technology to Unmet Needs
VI. Statements Relating to the Impact of Technological Change

The first five volumes contain studies prepared for the Commission. This appendix volume consists of a group of statements by various interested organizations and individuals in response to a request from the Commission for their views on the impact of technological change. Though the Commission does not necessarily endorse the information and views presented here, it considers them of sufficient value to have directed their publication. The statements were written between June and December of 1965, which accounts for occasional discrepancies in data.

A number of the responses are not included in this volume. In several instances, respondents asked that their replies be kept confidential. Pertinent articles and speeches which have been published elsewhere were also omitted, as were a number of very brief replies.

The Commission found these materials most helpful in its deliberations and wishes to express its gratitude to all who replied to its query.

This volume was edited and prepared for publication by Judith Huxley.

Garth L. Mangum,
Executive Secretary.

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I. The Outlook for Technological Change
II. The Employment Impact of Technological Change
III. Adjusting to Change
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V. Applying Technology to Unmet Needs

Commission's Letter Requesting Statements

The National Commission on Technology, Automation, and Economic Progress was established by Public Law 88–444 and directed to report to the President and Congress by January 1, 1966 on an unusually wide range of issues relating to the impact of technological change upon our economy and society.

The mandate to the Commission is as follows:

> (a) Identify and assess the past effects and the current and prospective role and pace of technological change;
>
> (b) Identify and describe the impact of technological and economic change on production and employment, including new job requirements and the major types of worker displacement, both technological and economic, which are likely to occur during the next 10 years; the specific industries, occupations, and geographic areas which are most likely to be involved; and the social and economic effects of these developments on the Nation's economy, manpower, communities, families, social structure, and human values;
>
> (c) Define those areas of unmet community and human needs toward which application of new technologies might most effectively be directed, encompassing an examination of technological developments that have occurred in recent years, including those resulting from the Federal Government's research and development program;
>
> (d) Assess the most effective means for channeling new technologies into promising directions, including civilian industries where accelerated technological advancements will yield general benefits, and assess the proper relationship between governmental and private investment in the application of new technologies to large-scale human and community needs;
>
> (e) Recommend, in addition to those actions which are the responsibility of management and labor, specific administrative and legislative steps which it believes should be taken by the Federal, State, and local governments in meeting their responsibilities (1) to support and promote technological change in the interest of continued economic growth and improved well-being of our people, (2) to continue and adopt measures which will facilitate occupational adjustment and geographical mobility, and (3) to share the costs and help prevent and alleviate the adverse impact of change on displaced workers.

As you can see, the mandate is very comprehensive. The Commission cannot hope to successfully accomplish its assignment in the brief time available without the assistance of knowledgeable persons in industry, labor, and the universities. Since extensive hearings are not possible, we invite your opinions or statements on the issues that are quoted above. In the event you wish your reply to be treated as confidential, we would do so. However, with your permission, we are considering having these statements published separately by the Commission.

Your response to this request can be a valuable contribution to the work of this Commission. We would be happy to receive anything you care to contribute with whatever evidence you are able to provide, and assure you that your reply will be carefully studied by members of the Commission and the staff.

Sincerely yours,

Garth L. Mangum
Executive Secretary

STATEMENT

Prepared for the Commission
by the
Air Line Pilots Association
Chicago, Illinois

Statement by the Air Line Pilots Association

The following comments are confined to the air transport phase of the aviation industry as it applies to flight deck operating crew members employed in common carriage air transportation and relates to the people we represent in this industry.

We cannot answer the questions posed in your letter in the true sense for which they are intended and the general application with which automation is generally looked upon. The activities associated with the flight deck operating crew, or for that matter the cabin crew, are not generally adaptable to automation within its general sense of reference. By and large, this industry could use more automation when and if it is technically feasible without its having any effect on the number of persons employed to perform the service.

The nature of this industry is such that any automatic devices or equipment must adhere to a fail-safe philosophy in order to be acceptable from a purely safety standpoint. As an example, the automatic pilot is a device which has the capability of flying the airplane within certain regimes of flight. However, it must have fail-safe characteristic limits established over which it cannot exercise excessive control. It must also have instantaneous disconnect in order that the human pilot can continue to fly the aircraft with the automatic pilot disconnected from the control functions. These requirements are necessary so that excessive loads not be imposed on the aircraft during the regime of high speed flight to avoid destructive structural failures on the aircraft or its components.

Automation, as such, when and if established within the foreseeable future, will enable the industry to operate with lower weather minimums than are presently foreseeable. This will not result in a reduced number of personnel required to operate the aircraft.

This industry, by and large, has been a growth industry over its entire period of existence with only a few leveling out periods, resulting in a steady increase rather than decrease in total employment. The air carrier industry within the United States and the U. S. carriers operating foreign service perform complete service requirements with a flight crew complement of slightly less than 24,000 people. So, insofar as flight deck crew members are concerned, this industry is a relatively small portion of the total work force, particularly when one considers the total public service rendered in terms of passenger miles and cargo ton miles flown.

STATEMENT

Prepared for the Commission
by the
American Federation of State, County, and
Municipal Employees
Washington, D.C.

Statement by the American Federation of State, County, and Municipal Employees

AUTOMATION

In November of 1965, Jerry Wurf, president of the American Federation of State, County, and Municipal Employees, told a seminar at the New School for Social Research in New York: "While the threat of automation to destroy jobs certainly exists in some sectors of the economy, that will not be the case in local government." This statement is substantiated by a survey on automation conducted by the Education and Research Department of AFSCME.

In order to determine the extent and effect of automation in State and local government, the department conducted a survey. Questionnaires were sent to various State, county, and local agencies and to union councils.

The department was primarily interested in how many agencies had implemented electronic data processing (EDP) and what their experience was in regard to increases or decreases in employment because of EDP, retraining of workers to operate new equipment, types of training, and the fate of displaced employees. This information was then used to determine what courses of action are required to protect the jobs and status of the union membership.

The results of the survey showed the following:

In one form or another 63.7 percent of the agencies responding had installed EDP systems. The size of the operations varied from departments employing four or five people to departments employing several thousand. The remaining 36.3 percent of the agencies which answered the questionnaire were not presently operating EDP systems, but many were contemplating the use of EDP in the future.

Of the agencies using EDP, 44.2 percent showed an increase in the number of employees after the systems were installed. The level of employment in 38.5 percent stayed the same, while only 17.3 percent claimed that employment had decreased. In order to determine overall employment increases, the total personnel in all agencies before and after EDP was compared. Employment increased by about 17.3 percent while overall displacements amounted to approximately 1.0 percent.

The fates of the displaced 1.0 percent are as follows (in percent):

Retired	1.3
Placed in jobs outside	.3
Laid off or voluntarily quit	6.5
Downgraded	6.5
Reassigned	21.2
Promoted	64.2

In most agencies employees were retrained to fill the newly operated positions. The respondents in 55.8 percent of the cases indicated they had definite programs for retraining workers. The other 44.2 percent had no such programs and approached the situation in a hit-and-miss fashion. It was in the latter cases that trained EDP operators were often brought in from the outside, displacing other employees. (The value of a formulated workable retraining program cannot be underestimated.)

An example of a problem-free conversion to automation was the Michigan Liquor Control Commission. The commission installed its EDP system in August 1964. Before automation the department employed 24 people; 23 of them were retrained for EDP. The person not retrained was reassigned to another department without loss in grade or pay. From the outside labor market four people were hired, bringing the total for the department to 27. In this case the conversion to EDP was made with a minimum of inconvenience, but in large part, this was the result of joint consultations which worked out all problems prior to EDP installation.

A less desirable situation exists in Multnomah County, Oregon. There, the implementation of EDP has existed for some time. Under the laws of Oregon there is a provision that allows machinery to be set up which would recognize unions as the bargaining agents for civil servants in classified positions. The law, however, does not apply to temporary employees. Consequently, there are many employees doing the same work as classified personnel, but who hold only temporary status.

The reason for this plight is that management is fearful of the effects EDP will have on employment. Rather than be faced with the prospect of having to lay off permanent employees, management's conscience is eased by keeping an army of temporary workers. Should the need arise for layoffs, the temporaries can be terminated with no repercussions. It is obvious management is exploiting a weakness in the Oregon law. The employers realize that if all the employees were permanent and were represented by an authorized union, such a practice would not be tolerated.

The effect has been for the workers to live in a state of limbo, always fearful of the day they will be thrown out of a job. The situation should not have been allowed to deteriorate to the state it is in now. By establishing a joint consultation committee the problem could have been averted.

These cases are shown as examples of the way conversion to EDP should and should not be managed. In the survey there were many cases which fell in between the two cited. The following section provides the means by which the union can help eliminate the adverse conditions of automation.

Union Role in Automation

Through the realization that automation cannot be prevented, the union can best help its membership by making every effort to alleviate potential fears the employees may have. This can best be done through negotiations.

Where possible, provisions should be written into agreements or laws which would cause employers to inform and educate workers about changes to be made. The most effective way to promote the interests of employees is through joint consultation committees. The committees should consist of representatives of management and the union. These representatives should have authority to make decisions concerning the methods and procedures by which the conversion to EDP will take place. For the joint consultations to be successful, it is imperative that meetings be held far enough in advance of a change, so discussions and decisions will be constructive and meaningful.

Areas of Negotiation and/or Joint Settlement

Training. It is often more expedient for employers to hire experienced personnel from without than to retrain employees from the existing work force. Although EDP requires new skills, most of them can be acquired by present personnel through training. It is essential to the stability of the union membership (and incumbent employees) that the present work force be given the first opportunity to fill newly created positions.

A problem involving seniority may arise in the selection of personnel to be trained. Even though ability is necessary, seniority is the basis on which those qualified should be selected.

It is also important to establish what type of training is to be given and who is to pay for it. There are any number of training programs which can be set up. Some State and local governments have their own on-the-job training programs. Others use the programs provided by the EDP equipment manufacturer. One of the most overlooked but accessible training programs is that provided by the Federal Manpower Development and Training Act under the U.S. Department of Labor, Bureau of Apprenticeship and Training.

Displaced Workers. If workers must be displaced, it is necessary that they be placed in other jobs commensurate with their present positions. All attempts should be made to get them reassigned or promoted. If this is not possible, they should be aided in finding other work outside the government. They are entitled to all the help which can be given in order to maintain their economic status.

Liberal severance allowances and continuation of fringe benefits are items which are negotiable. Also, if moving expenses are involved when people change jobs, arrangements should be made whereby the employer pays the costs.

Safety and Working Conditions. EDP means machinery, and where machinery is being used special rules must be established to protect workers from injury. Unions, through safety committees, should study all danger possibilities and see that an effective safety program is initiated.

Special work surroundings also are sometimes required with EDP. For instance, areas where computers are placed sometimes require temperatures to remain at a level which is uncomfortable for people. Better lighting may be needed. These are some of the kinds of conditions which must be dealt with and satisfied.

Economic Effects of Technological Change

There is no doubt that automation increases efficiency, raises production, and frees people from dull routine. This is salutary, but too often it not only frees people from the dull routine of a particular job, it frees them to no job at all. Therefore, in spite of the "advantages" of automation, if those adversely affected were given the alternatives of a dull job or no job at all, it is not hard to see which they would choose.

It has been said that society has chosen technological change as a means to gain a fuller and more varied life away from the job. This is a peculiar assumption. Society does not—nor does it have the continuity of interests to—make such decisions. The decisions are made singularly by those seeking higher profits and/or lower costs. The human considerations involved in such decisions are given secondary status and at times appear to be nonexistent.

As in all instances of technological change, its effects permeate the whole social system before they are fully realized. Although there is no need to elaborate on the fate of the coal miners and their experience with automation, we must face the fact that we have not yet found a satisfactory way to deal with such situations. Whole communities are still feeling the economic squeeze which can be laid to automation. The competition for the diminishing supply of unskilled and semiskilled jobs is overwhelming. There is nowhere for many to turn except to charity and welfare.

The argument of whose responsibility it is to protect society from the ravaging effects of automation still goes on. Nobody wants to pay the costs; but how can we afford not to?

There are many who argue that the powers that control the wheels of progress and offer the great promises that automation can bring should pay the whole cost. This is not entirely true. However, let them make sure that those who must bear the costs at least share in the benefits derived from change.

The Federal, State and local governments, which are often the villains of automation, are best situated to be the heros. They are by far best adapted to establish training programs, coordinate labor supply and demand, and, where practical, create jobs. There are many needs for conservation, recreation, beautification, and highway programs at all levels of government. However, for there to be enough of this type of program to be effective, the politicians are going to have to show more intestinal fortitude and imagination than they have up to now.

Unions are the catalyst which can start the cauldron boiling. By providing resistance to the adverse effects of automation, they are waking society to the injustices which have prevailed. Furthermore, they are furnishing many of the ideas and methods which will give relief and equity to the victims of automation.

Individuals, as members of society, also have their role to play. With the effects of automation obvious to all, it is imperative that individuals begin to realize that they too have a contribution to make. The most effective gift they can give is to upgrade their skills in order to keep abreast with progress and change. Not all can do this without help. However, through the cooperative efforts of unions, business, and governments, they should be given every opportunity.

STATEMENT

Prepared for the Commission
by the
American Iron and Steel Institute
New York, New York

Statement by the American Iron and Steel Institute

Technological Change and Employment in the Steel Industry

In the public debate over the impact and rapidity of technological change, the steel industry has received a good deal of attention. Starting with somewhat exaggerated notions about the implications of the introduction of basic oxygen furnaces for steelmaking and "automated" rolling mills for steel processing and the downward trend in steel employment over the last decade, some people have conjured up a picture of future employment opportunities in steel nearly as bleak as that in bituminous coal mining. As only one example of this, the president of United Steelworkers of America, Mr. Abel, has said that if all steel produced in the United States were made in plants employing the most up-to-date available equipment, our total annual requirements could be met with a mere 100,000 production and maintenance employees instead of the present 500,000.[1]

Since, to a large segment of the public, steel is symbolic of basic industry, and developments in the steel industry attract attention out of all proportion to its actual impact on the economy, it is important that the Commission have a balanced view of both current and future technology and employment in steel.

1. Rates of Technological Change

There is no direct measure of the overall rate of technological advance in steel or any other industry. However, since one effect of changing technology is a reduction in unit manpower requirements, changes in output per man-hour reflect technological as well as other changes. Over fairly long periods, the average rate of change in output per man-hour is a reasonably good indirect indicator of the rate of technological advance.

During the last 25 years, the average annual increase in output per hour worked by all employees in steel has been on the order of 2 percent (see table 1).[2] As would be expected in an industry characterized by wide cyclical variations, short-term changes have departed sharply from that trend, but there is no evidence of a pronounced, sustained change in the rate of increase. During the period 1940–47, the average annual gain was 2.1 percent; between 1947 and 1957, it was just under 2 percent; and from 1957 to 1964, it was 2.2 percent. It is worthy of mention that the new Bureau of Labor Statistics series based on weighted production and BLS man-hours shows a similar rate of gain (2.4 percent) during the period 1957–64.[3] It should also be noted that in recent years, output measures have been affected by the growing tendency toward higher strength and lighter steels and more finishing operations on products in the producing plant. That effect is especially important to unweighted measures, such as

TABLE 1. STEEL SHIPMENTS PER 1,000 MAN-HOURS (ALL EMPLOYEES), 1940-64

Year	Shipments per thousand man-hours
1940	46.9
1941	52.9
1942	51.0
1943	49.5
1944	49.7
1945	48.3
1946	48.3
1947	54.0
1948	54.1
1949	54.1
1950	59.5
1951	58.7
1952	57.2
1953	59.6
1954	56.5
1955	65.9
1956	66.0
1957	65.3
1958	61.0
1959	69.2
1960	65.5
1961	65.3
1962	70.0
1963	73.8
1964	76.2

Source: *Annual Statistical Report*, AISI, 1964.

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[1] Inaugural message reported in *Steel Labor*, June 1965, p. 6.

[2] BLS had a continuous series applying to production workers only for the period 1939-57. Its present series using modern product weights and man-hours of all employees engaged in the manufacture and sale of steel mill products begins with 1957. For long-term comparisons, therefore, it is necessary to use AISI net shipments and man-hours worked data.

[3] "Indexes of Output per Man-Hour—Steel Industry, 1957-63," BLS, Nov. 1964, and subsequent releases.

ingot production and shipments, but it is present also in the BLS weighted output series since that depends on fixed man-hour weights which remain unchanged for considerable periods.

In passing, it should be noted that the average rates shown by AISI and BLS data for the last 7 years are considerably below the rate estimated by the Council of Economic Advisers "after correction for variations in operating rates," to be "about 3 percent per year"[4] A discussion of the questionable validity of the Council's "corrections" and, therefore, the rate itself would not be germane to this report.[5] However, it is important to keep in mind that the Council's estimate does not cover any period prior to 1957. Thus, it does not shed any light on the claim that the rate of increase has accelerated in recent years. Available evidence indicates the contrary.

2. Factors Limiting Acceleration of Technological Change

Steel's comparatively low rate of increase in output per man-hour and the remarkable uniformity of that rate over long periods are not what a reader of popular accounts of dramatic changes in steel manufacturing processes would expect. However, they are quite consistent with the realities of introducing technological changes into an industry like steel.

Capital investment is high in steel relative to revenues and employment. For example, in terms of capital invested per production worker, steel ranked above all other major manufacturing industries, except tobacco, chemicals, and petroleum, in 1960.[6] Major changes in technology, therefore, require very large amounts of capital funds, but steel's return on investment has been below that of all but a few other manufacturing industries for many years (see table 2).[7] Heavy capital requirements and comparatively low rates of capital generation have limited the rapidity with which new technology can be developed and applied to steel operations.

TABLE 2. COMPARISON OF STEEL INDUSTRY RETURN ON NET WORTH WITH AVERAGE RATE OF RETURN FOR LEADING MANUFACTURING INDUSTRIES

Year	Steel industry (percent)	Leading manufacturing industries (percent)	Steel industry rank	Number of manufacturing industries
1940	8.5	10.3	32	45
1941	9.6	12.4	40	44
1942	6.5	10.1	45	45
1943	5.6	9.9	43	44
1944	5.2	9.8	44	45
1945	5.0	9.1	44	45
1946	7.5	12.1	41	45
1947	11.3	17.0	42	45
1948	14.0	18.9	38	45
1949	11.5	13.8	24	45
1950	15.3	17.1	28	45
1951	12.3	14.4	25	46
1952	8.8	12.3	35	46
1953	11.6	12.5	21	46
1954	9.4	12.4	32	46
1955	15.2	15.0	14	41
1956	13.9	13.9	17	41
1957	13.2	12.8	17	41
1958	8.2	9.8	27	41
1959	8.4	11.7	35	41
1960	7.8	10.6	29	41
1961	6.4	9.9	33	41
1962	5.4	10.9	41	41
1963	7.3	11.6	37	41
1964	9.2	12.7	35	41

Source: *Monthly Letters*, First National City Bank, Apr. issues.

Another factor which has exerted a dampening influence on steel's ability to adopt new techniques is the failure of steel demand to grow as fast as the economy as a whole. Relative to real GNP, apparent steel consumption (in terms of ingot equivalent) in the 1960–64 period was about 5 percent below the level of 1945–49 and about 9 percent below the level attained in the period 1955–59 which included the capital goods boom. Per capita consumption shows a somewhat better picture, the average for 1960–64 being about 20 percent above that of 1945–49. However, average per capita consumption has not changed over the last

TABLE 3a. COMPARISON OF STEEL INGOT PRODUCTION, POPULATION AND GROSS NATIONAL PRODUCT (CONSTANT DOLLARS)

Year	Ingot production (net tons)	Population (including Armed Forces abroad) (thousands)	GNP in constant dollars (billions 1958 dollars)
1940	66,982,686	132,594	227.2
1941	82,839,259	133,894	263.7
1942	86,031,931	135,361	297.8
1943	88,836,512	137,250	337.2
1944	89,641,600	138,916	361.3
1945	79,701,648	140,468	355.4
1946	66,602,724	141,936	312.6
1947	84,894,071	144,698	309.9
1948	88,640,470	147,208	323.7
1949	77,978,176	149,767	324.1
1950	96,836,075	152,271	355.3
1951	105,199,848	154,878	383.4
1952	93,168,039	157,553	395.1
1953	111,609,719	160,184	412.8
1954	88,311,652	163,026	407.0
1955	117,036,085	165,931	438.0
1956	115,216,149	168,903	446.1
1957	112,714,996	171,984	452.5
1958	85,254,885	174,882	447.3
1959	93,446,132	177,830	475.9
1960	99,281,601	180,684	487.8
1961	98,014,492	183,756	497.3
1962	98,327,785	186,656	530.0
1963	109,260,949	189,417	550.0
1964	127,075,767	192,119	577.6

Source: Ingot production: *Annual Statistical Report*, AISI, 1964; Population: *Statistical Abstract USA*, 1965, U.S. Dept. of Commerce; and GNP: *Survey of Current Business*, U.S. Dept. of Commerce, Aug. 1965, table 2.

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[4] *Report to the President on Steel Prices*, Apr. 1965, pp. 44-45.

[5] An analysis of that report and particularly the Council's estimates of increases in output per man-hour is found in Jules Backman's *Steel Prices, the Steel Industry, and the National Economy* issued by Republic Steel Corporation in July 1965. See especially pp. 49-66.

[6] *The Economic Almanac, 1964*, Conference Board, p. 273; *Annual Statistical Report*, AISI, 1960, pp. 13-14. The average for all manufacturing was $18,227 and for steel, $25,780. Since capital equipment in steel is comparatively long-lived, the book value of steel assets represents a smaller proportion of current value than is the case in manufacturing industries generally.

[7] Steel equaled the average for manufacturing in 1956 and exceeded it in 1955 and 1957 by fractions of percentage points. It has been below the average in all others of the last 25 years.

Table 3b. Average Estimated Steel Consumption in Ingot Tons Per Million Dollars of Real GNP and in Pounds Per Capita

Year	Apparent consumption relative to	
	Real GNP	Population
1945-49	2,173	976
1950-54 [1]	2,473	1,226
1955-59	2,262	1,190
1960-64	2,069	1,173

[1] Affected by the Korean war.

Sources: Real GNP: *Survey of Current Business*, Aug. 1965; population: *Statistical Abstract USA*, 1965; and steel consumption: computed from *Annual Statistical Report*, AISI, 1964.

decade (see tables 3a and 3b). Thus steel use has been growing less rapidly than the economy as a whole and about as fast as the population. Those recent consumption figures are, of course, adversely affected by the growing tendency toward higher strength and lighter weight steel products. Domestic steel production has done less well over the last 5 years than those comparisons indicate because of the rise in imports. Over the period 1960–64, imports accounted for 6 percent of domestic consumption, rising from 4.7 percent in 1960 to 7.3 percent in 1964 and nearly 10 percent in the first half of this year.

Within the period 1960–64, there was a marked increase in steel consumption. If present economic conditions continue, demand for steel products may be expected to rise at least as fast as the population, although probably not as rapidly as real GNP.

Perhaps the most important deterrent to widespread adoption of new techniques arose from events in the first postwar decade. The increase in steel demand relative to GNP and to the population during the first decade after World War II led to large capital expenditures designed primarily to increase capacity. The subsequent decline in steel output and public concern over excess steelmaking facilities have tended to make people forget the pressures—both public and private—upon the industry to increase output during the late 1940's and early 1950's. Response to those pressures and to the evidence of a rapid rise in the economy's steel requirements resulted in the retention and improvement of facilities which ordinarily would have been abandoned and the large-scale construction of facilities embodying well-tested technology. It should be recalled that at this time, the technological developments which are so prominent now—notably ore pelletizing, the basic oxygen furnace, and continuous casting—were in very early stages of development and had not come into commercial use anywhere. The atmosphere was such as to discourage the adoption of untried techniques which would have made rapid increases in capacity less certain. In consequence, the abrupt dropoff in demand for steel which occurred after the middle 1950's found the industry with enormous capacity, much of it recently built and very little of it embodying new technology. That overhang affected the rate of technological change in the next decade. Money was scarce; demand, although generally lower, was extremely irregular with very high peaks in early 1959, 1960, 1962, and 1963; and the future trend of steel demand was uncertain.

Under even the best economic conditions, however, large, secular increases in the overall rate of technological advance and, therefore, the rate of increase in output per man-hour, are unlikely. Most steel production takes place on an enormous scale and involves a very high degree of integration among processes. The introduction of a new technique requires not only that the process must be tested sufficiently to ensure its success in large-scale operation but also that it fit in properly with existing facilities. Developing even the most promising ideas to that stage is slow and expensive.

The adaptation of the oxygen steelmaking process to conditions existing in this country is an instructive example. Developed in Europe after World War II under highly special conditions—the need to replace worn-out or devastated equipment, small-scale operations, and the use of high-phosphorous iron ores—it was a great success. Adapting it to conditions in the United States, however, involved formidable problems. In fact, the Europeans who first used it commercially predicted that furnaces larger than about 70 tons could not be built successfully. A unit of that size could not be used economically by a major steel producer in the United States as a substitute for efficient and only partially depreciated open hearths. Even in this country it was believed by some reputable scientists outside the steel industry that the rate of oxygen flow required in a vessel roughly 4 times the size of those operating successfully in Europe was impossible of achievement. In fact, the management of Jones and Laughlin was so advised on the eve of the startup of its first 230-ton units.[8] This sort of experience is not unusual. What works well in a laboratory or in small operations may not work at all or may work only after the most painstaking and painful research and development effort in operations on the scale required by the larger steel companies.

Another limiting factor frequently overlooked is the ability of engineering organizations and the makers of large equipment to supply the plans and equipment for newly developed facilities. There are never at any one time very many engineering organizations or builders of equipment capable of handling large-scale projects. Thus, if capital were readily available and all steel producers wanted to replace all their open hearths with oxygen furnaces at once, they would find that the designers and makers of such equipment could not possibly satisfy the demand.

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[8] Transcript of testimony of William J. Stephens, president, before the Trade Information Committee, Feb. 19, 1964, vol. 40; pages not numbered.

Much new technology is directed not to increased capacity and lower manpower requirements in steel producing plants but to steels of lighter weight, greater strength, superior finish, and closer tolerances. This is increasingly true as steel users adopt more high-speed fabricating equipment. While such techniques as vacuum degassing of steel and automatic gage controls on steel rolling mils reduce waste and improve yield in the producing plants, their principal benefits appear in the customers' operations. Thus, important capital investments in steel plants may have little or no measurable effect on output per man-hour in the steel industry but may contribute to important improvements in consuming industries.

Finally, each major technological advance affects only one part of the integrated operation in a steel producing plant. The dramatic basic oxygen furnace affects directly only the steelmaking process and not even all of that. It may actually increase total manpower requirements in the coke ovens and blast furnace departments since it requires at present a higher proportion of pig iron than the open hearth. It has little or no effect on the process of pouring ingots and rolling them into semifinished and finished products. In fact, its only important manpower effects are on the forces directly concerned with furnace operation—a fraction of the total force involved in steelmaking alone. This is true of most other new or improved processes. Furthermore, because of the variety of steel products, the inherent limitations of some new processes require the retention of older equipment. Significant economies are achieved from many of the new processes only if they are in proper balance with the processes which precede and follow them in the overall production line. This requires that they operate at a fairly constant rate. But there is nothing constant about the demand for steel.

The various factors described above help explain the absence of dramatic changes in the secular rate of increase in output per man-hour. They also indicate that although output per man-hour may increase at a higher rate in the future, dramatic changes are unlikely. The book value of assets in the steel industry is slightly under $20 billion—far less than the replacement costs of those assets. Expenditures for new and improved facilities are currently running at the very high rate of about $2 billion a year. It is quite obvious, therefore, that radical changes in the overall efficiency of the industry are not to be expected.

3. Factors Affecting Changes in Steel Employment

The largest single factor in determining the level of total employment in steel is, of course, the demand for steel products. This can be illustrated by a simple example. Steel shipments were almost identical in 1955 and 1964 (84.7 versus 84.9 million tons). Monthly average employment in 1955 was just under 625,000. Since output per man-hour has increased at an average annual rate of 2.2 percent, average employment in 1964 could be expected to have been about 516,000. Actually, it was nearly 554,000 (see table 4). The difference is accounted for largely by the increase in paid time off (principally in the form of vacations) over the intervening period, with a resulting reduction in the average number of hours worked per employee.

TABLE 4. STEEL EMPLOYMENT AND PRODUCTION, 1947-64

	Monthly average total employment		Ingot production	
Year	(thousands)	Year to year change (percent)	(millions)	Year to year change (percent)
1947	573.7	—	84.9	—
1948	591.5	+3.1	88.6	+4.4
1949	580.8	−1.8	78.0	−12.0
1950	592.3	+2.0	96.8	+24.1
1951	638.3	+7.8	105.2	+8.6
1952	621.9	−2.6	93.2	−11.4
1953	650.2	+4.6	111.6	+19.7
1954	581.9	−10.5	88.3	−20.9
1955	624.8	+7.4	117.0	+32.5
1956	620.7	−0.7	115.2	−1.5
1957	623.8	+0.5	112.7	−2.2
1958	523.5	−16.1	85.3	−24.3
1959	515.1	−1.6	93.4	+9.5
1960	571.6	+11.0	99.3	+6.3
1961	523.3	−8.4	98.0	−1.3
1962	520.5	−0.5	98.3	+0.3
1963	520.3	—	109.3	+11.2
1964	553.6	+6.4	127.1	+16.3

Source: *Annual Statistical Report,* AISI, 1964, tables 1 and 6.

An examination of year-to-year changes during the postwar period shows that, with three exceptions, ingot production and total employment moved in the same direction, although changes in production were usually much greater than those in employment. Two of the exceptions involved 1956 and 1959 in which average monthly employment figures were distorted by strikes. The other was in the year 1961–62 when changes in both employment and production were very small.

Attrition is, of course, an important factor affecting the impact of technological change on employment. Year in and year out employees die, retire, or leave the industry voluntarily, creating job opportunities for others. Data published by BLS show that since 1957, separations other than layoffs in the steel industry have been at a rate of more than 10 percent per year (see table 5).[9] That rate far exceeds the average annual increase in output per man-hour in the same period.

TABLE 5. SEPARATIONS OTHER THAN LAYOFFS IN STEEL, 1952-63

Year	Average annual separation rate per 100 employees
1952	25.2
1953	21.6
1954	8.4
1955	15.6
1956	14.4
1957	12.0
1958	7.2
1959	12.0
1960	9 6
1961	10.8
1962	10.8
1963	13.2

Source: *Employment and Earnings*, BLS.

A major factor affecting total employment, particularly in plants having their principal markets near the Atlantic, Pacific, and Gulf coasts, has been the substantial rise in imports and the decline in exports of steel mill products. In 1957, imports totaled 1.2 million tons and accounted for about 1.5 percent of domestic steel consumption. By 1964, imports had risen to 6.4 million tons and supplied 7.3 percent of our total steel requirements (see table 6). Efforts of steel customers to build up inventories against a possible strike this year have accelerated the trend, and it is thought that for the year 1965, imports will have accounted for 10 percent of steel consumption. Meanwhile, exports have declined from 5.3 million tons, or 6.7 percent of total shipments, in 1957, to 3.4 million tons, or 4.0 percent of shipments, in 1964. The total adverse "swing" in that 7-year period has been about 7 million tons of shipments per year. Shipments by the domestic industry in 1964 were 85 million tons. If the 1957 relationships between imports and exports had obtained, shipments would have been about 92 million tons and there would have been the equivalent of more than 50,000 additional jobs.

TABLE 6. STEEL IMPORTS AND EXPORTS IN THOUSANDS OF NET TONS

Year	Imports	Percent of market	Exports	Percent of shipments
1st half 1965	4,939	9.0	1,158	2.3
1947	32	0.1	5,919	9.4
1948	148	0.2	3,950	6.0
1949	291	0.5	4,344	7.5
1950	1,014	1.4	2,639	3.7
1951	2,177	2.8	3,137	4.0
1952	1,201	1.8	4,005	5.9
1953	1,703	2.2	2,991	3.7
1954	771	1.3	2,792	4.4
1955	973	1.2	4,061	4.8
1956	1,341	1.7	4,348	5.2
1957	1,155	1.5	5,348	6.7
1958	1,707	2.9	2,823	4.7
1959	4,396	6.1	1,677	2.4
1960	3,359	4.7	2,977	4.2
1961	3,163	4.7	1,990	3.0
1962	4,100	5.6	2,013	2.9
1963	5,446	6.9	2,224	2.9
1964	6,440	7.3	3,435	4.0

Source: *Foreign Trade Trends*, AISI; data for 1950 and prior not fully comparable with late data.

Steel operations and, therefore, total employment are strongly affected by changes in domestic markets. Because of transportation costs, the market for a particular steel plant is limited geographically; changes in the location of consuming industries, either because of physical moves or declines of demand for their products in some areas and increases in others, greatly affect the operations at the steel plants which supply them. The rise or decline of an important consuming industry obviously affects the demand for particular steel products. Much of the equipment in steel plants is capable of producing only a limited type of product and can be adapted to other products only at great expense, if at all. Technological and product changes affecting operations of steel consumers also affect the demand for steel products.

Market changes have been very much in evidence during the postwar period. For example, the Pittsburgh and Youngstown districts have declined sharply in relative importance, while Cleveland, Detroit, Cincinnati, St. Louis, the Southwest, and the Far West have increased (see table 7). The Buffalo and Chicago districts accounted in 1964 for about the same shares of total steel production as in 1947. The Northeast's share increased in the first postwar decade but has not changed sub-

TABLE 7. STEEL PRODUCTION BY GEOGRAPHICAL DISTRICT (INGOTS AND STEEL FOR CASTINGS), IN PERCENT OF TOTAL

District	1964	1957	1947
Northeast Coast	14.0	14.5	12.2
Buffalo	4.8	5.7	4.9
Pittsburgh	20.0	22.0	26.3
Youngstown	8.6	9.4	13.2
Cleveland	5.7	5.1	4.7
Detroit	7.4	5.5	3.7
Chicago	20.6	19.8	20.3
Cincinnati	4.4	3.6	3.2
St. Louis	2.7	2.3	1.7
Southern	5.7	5.9	4.7
Western	6.1	6.2	5.1

Source: American Iron and Steel Institute.

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[9] Although military separations are included in the separations figure, such separations were of minor importance during the years 1958-63.

stantially since then. As to distribution of steel products among consuming industries, there has been a marked decline in the proportion of shipments to the transportation industry; a moderate rise in the importance of consumer durables (largely automobiles); and substantial increases in the shares going to plant and equipment, containers, and energy producing industries (see table 8). Exports have, of course, declined. Among products, there have been marked declines in the importance of rails, rods, wire and wire products, and semifinished products and bars. The share of total shipments represented by shapes and plates has been relatively static but there had been a very large increase in sheets, strip, and tin mill products.

TABLE 8. STEEL SHIPMENTS BY MARKET CLASSIFICATION AS PERCENTAGES OF TOTAL SHIPMENTS

Classification	1957	1964
Converting and processing	4.3	3.2
Forgings	1.3	1.3
Bolts, nuts, rivets, and screws	1.4	1.4
Steel service centers	18.2	18.3
Construction	15.7	12.9
Contractors' products	4.3	5.5
Automotive	17.8	21.6
Rail transportation	5.2	4.1
Shipbuilding	1.6	0.9
Aircraft	0.1	0.1
Oil and gas drilling	0.9	0.5
Mining, quarrying, and lumbering	0.4	0.4
Agricultural	1.4	1.6
Machinery, industrial equipment, and tools	5.6	6.3
Electrical machinery	2.6	3.1
Appliances, utensils, and cutlery	1.9	2.6
Other equipment	2.3	2.4
Containers	7.8	7.7
Ordnance	0.5	0.3
Export	5.7	3.2
Unclassified	1.0	2.6

Source: *Annual Statistical Report*, AISI, 1957 and 1964.

While we do not have any direct evidence of the effects on employment of changes in the relative importance of steel consuming industries and in the demand for categories of steel products, data are available as to employment in the steel industry (SIC–331) in various States (see table 9). Those data show that between 1953 and 1963, employment, as a percentage of total employment in the industry, remained unchanged in Alabama, rose substantially in Illinois and Indiana and moderately in Maryland, and declined in Ohio and Pennsylvania.

TABLE 9. EMPLOYMENT IN THE STEEL INDUSTRY BY STATES

State	Employees 1953		Employees 1957		Employees 1958		Employees 1963	
	(1000's)	(%)	(1000's)	(%)	(1000's)	(%)	(1000's)	(%)
Alabama	29.3	4.0	29.1	4.0	24.8	4.1	23.4	4.0
Illinois	48.2	6.6	49.3	6.8	44.0	7.3	47.2	8.0
Indiana	62.0	8.5	64.2	8.9	57.5	9.6	59.7	10.1
Maryland	28.9	4.0	32.3	4.5	29.8	5.0	29.2	5.0
New York	n.a.	—	n.a.	—	34.7	5.8	33.5	5.7
Ohio	131.2	18.0	123.2	17.1	97.9	16.3	92.6	15.7
Penna.	240.2	33.1	227.7	31.6	190.6	31.7	174.2	29.5
All U.S.	726.1		719.9		601.1		589.4	

Source: *Bull.* Nos. 1312-2 and 1370-2, BLS.

During the last decade, a very important factor affecting steel demand and total employment has been the practice on the part of customers to build up inventories or seek other sources of supply in anticipation of strikes. Uncertainty about the continuity of steel supplies has encouraged some customers to buy imported steel and others to engineer steel out of their products either by using other materials or by reducing the amount of material in the product. It is difficult to recover those market losses so long as there are periodic strike threats.

4. Adjustments to Technological Change

Although the general level of total steel employment has been affected much less by technological change than by fluctuations in the demand for steel, it is certainly true that a particular change at the time of its introduction may have a pronounced local effect on employment. The order of magnitude of that effect from the introduction of even quite large, new units is far less than the local effect of a wide swing in the volume of orders. For example, the introduction of a BOF shop at a plant employing about 16,000 people affected the jobs of about 150 employees. However, the change occurred during a period of rising orders and, as a result, all those affected who wanted jobs were placed elsewhere in the plant. Nevertheless, it is cold comfort to a man faced with the prospect of displacement from a familiar job because of technological change to be told that change is economically desirable and that it has little effect on steel employment generally. Technological change does not occur as an average or general phenomenon but as a particular event affecting individual employees, and its effects must be dealt with in that fashion.

The steel companies by agreement with United Steelworkers of America or unilaterally have established certain institutional devices which assist employees in making adjustments to technological change. The genesis of many, but not all, of those devices has been cyclical unemployment rather than displacement because of technological change or the reorganization of operations. However, they are useful in adjusting to changes of the latter type. First, there are the arrangements for determining who will have the jobs available after the change, including jobs elsewhere in the plant or in other plants of the company. Second, there are arrangements for training employees whose jobs are altered as a result of the change. Third, there are provisions for retiring on pension older employees who are adversely affected. Fourth, there is a program which supplements public unemployment benefits for those who are temporarily laid off. Finally, severance payments are provided for those ineligible for other jobs or retirement on pension and whose prospects for a return to work with the company are remote.[10]

While there are variations in practice followed because of differences in size and location of plants, kinds of operations, and number of employees involved, by and large the following procedures are applied by most steel companies when a change is impending.

When plans to abandon, discontinue, or replace certain facilities are developed, as far in advance of the actual shutdown as possible, an analysis is made to determine the number of employees affected. Their service, age, seniority status, and ability to perform other work in the plant are determined. Their status with respect to pension, severance, and unemployment compensation benefits is also determined. The job opportunities on replacement facilities, where involved, are taken into consideration.

At this point, the scope of the problem is known and the next step is to determine what plans can be made to absorb these employees. The prospects of placement at the plant concerned are appraised as are those at sister plants in the area or elsewhere, and those with outside employers in the area. Estimates are made of which individuals, if any, are likely to exercise their pension, severance, supplemental unemployment benefits, or seniority rights. A determination is made of what is the most reasonable way to alleviate the resultant displacement by such measures as utilizing turnover to absorb such employees and limiting the hiring of new employees where feasible, transferring employees to other jobs, retraining employees either for new jobs on the replacement unit or providing on-the-job training where necessary in cases of transfer to other jobs in the plant, circulating rosters of available employees and their skills to other plants in the company if prospects of placement exist, and, similarly, contacting other employers in the vicinity or the State Employment Office in the area. Improvements in the orderly dissemination of information on job openings would increase the effectiveness of this activity.

General announcements and notices are made at the appropriate time to international, district, or local union representatives, to the individual employees either personally or by letter, and to the general public.

At the proper time interviews are conducted with the employees involved to discuss their individual status both as to other employment prospects and what rights they have to pensions, vacations, insurance coverage, severance pay, SUB, other jobs, and so on. The employees decide which of the available options they choose to select.

To the maximum extent practicable the arrangements decided upon are put into effect following the announcement and appropriate union representatives are kept informed as to what is being done and the progress being made.

The degree of success realized through these procedures, of course, varies in relation to the circumstances surrounding each specific case of technological improvement. The range is from cases completely successful in alleviating the change, to those where there simply is no way within our control to obviate the impact upon some of the employees involved.

The cyclical nature of steel demand complicates the process of adjustment. Most important technological changes in steel involve fairly long lead times and, consequently, at the time a change is authorized, there is no way of determining what the level of operations will be when it actually occurs. That greatly reduces the possibility of giving any sort of meaningful notice of the consequences of the change well in advance of its occurrence.

5. Expectations for the Future

The principal limitations on the rate of technological change in steel—availability of capital and growth of demand at a rate lower than that of the economy as a whole—are not likely to be removed in the near future. While some developments such as the basic oxygen furnace and continuous casting are expected to reduce the capital required per ton of output, others affecting finishing operations may not reduce and may actually increase capital requirements. It is, of course, impossible to predict the net effect of all the changes now underway or anticipated on the industry's capital requirements, but it is certain that steel will continue to require large amounts of capital relative to output. Thus, irrespective of the ingenuity of research and development scientists and engineers, there is no reason to expect a substantial secular change in the rate of productivity increase, or in the general level of steel industry employment.

Similarly, steel demand is expected to continue to show cyclical patterns, although a sustained high rate of economic activity would reduce the amplitude of expansions and contractions. It is possible—and much to be hoped—that a way can be found to reduce the threat of labor disputes and their contribution to irregularity of demand. It is also possible that changes in the factors affecting world steel trade may make the balance between imports and exports more favorable to the United States. But even if all those improvements occur, steel will continue to be used primarily in products the demand for which is strongly influenced by the level of private investment and consumer durable goods purchases. We can continue to expect, therefore, that total steel employment will fluctuate with short-term changes in demand and that over the years, increasing steel output per man-hour will be balanced by continuing growth in the overall market for steel products. While the introduction of new facilities will involve some displacement and relocation of employees at particular places, adjustments are eased by normal turnover and existing arrangements for training and transfer to other jobs.

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[10] Mention should also be made of the limited employment and earnings guarantees provided under the plans for sharing cost savings adopted by Kaiser and Alan Wood.

STATEMENT

Prepared for the Commission
by the
American Society of Tool and Manufacturing Engineers
Dearborn, Michigan

Statement by the American Society of Tool and Manufacturing Engineers

There seems to be little doubt but that advances in technology and the advent of automation and economic progress in general have had profound effects on the economic life of our country. However, whether the individual effects have been mainly beneficial or harmful is far from clear. Certainly, the standard of living in this country seems to have had a continued upward trend.

New technology and automation, no matter what definitions you use for them, have, when considered as separate independent phenomena, resulted in the elimination of some individual jobs. However, in this complex world it is not possible to consider any phenomenon as independent. Each phenomenon must be considered as a part of the immensely complicated industrial and social environment within which we live. Therefore, the determination of the effects of any technological advance of automation, or of recent economic changes, approaches the impossible.

Our members are manufacturing engineers, not social scientists or economists, and, therefore, are inadequately equipped to answer socioeconomic questions. Certainly the man who is displaced by a machine or for any other cause beyond his control deserves our sympathy, consideration, and help in preparing himself for and in locating other employment. However, manufacturing engineers are dedicated to increasing productive efficiency in manufacturing, to the end that more goods might be produced for more people. It follows that we welcome mechanization, automatic controls, and all advanced forms of technology which reduce the cost of any given product.

Progress means change; purposeful directed change. It means introducing new devices and new machines to replace the old, and it means that new skills are needed to operate the new machines, to control them, to repair them.

True, if we assume that the total number of units of a given product is going to remain substantially the same, the introduction of new technologies would tend to create a growing group of permanently displaced workers. But this assumption that progress in production is not accompanied by progress in consumption is patently false. The American development is evidence that increasing the productivity of the individual results in developing a more abundant life for all. As old needs are satisfied, new ones arise to be satisfied in their turn.

True also, the balance between increased productivity and increased needs is an unstable one, shifting now in one direction, now in another. But over the last 20 years at least, there has always been a lag between industry's need for new skills and the ability of the labor market to satisfy them. Thus, while on the one side there are workers displaced by new machines, on the other side there are new machines looking for workers. The problem becomes accentuated in localities and in industries in which business groups, trade unions, and other forces put a temporary artificial brake on the natural evolutionary process.

In our experience, the problem is primarily one of maintaining the labor force—managers, engineers, technicians, operators—abreast of developments as they occur. All elements in the manufacturing operation must be motivated to learn, and they must be given the opportunity to learn the new developments, techniques, and skills that progress brings forth. The problem is primarily one of motivation and of education.

We note, for instance, that the problem of technological unemployment is least acute among engineers and other professional groups; that indeed, there are not enough engineers to fill the urgent needs of American industry. We believe this to be caused by the fact that the engineer and the professional in general is educated enough to know that his education is never completed, and he keeps up with new scientific and technical developments that are likely to affect him by continuing his education through academic channels and through his participation in the educational activities of the professional society in his field.

At the same time we are made painfully aware of the fact that the learning process is least developed among those who need it most; that the closer a worker comes to being pure muscle, the less apt he is to pursue the quest for more knowledge and new skills.

Being specialists in the exact and engineering—rather than the social—sciences, we do not presume to make recommendations on how to motivate the unlearned to learn. Knowing the present needs, and being able to make a general forecast of the future needs of the manufacturing engineering industry, we offer the suggestion that great emphasis be placed on education, especially scientific and technical education, at all levels. Already the illiterate is practically unemployable in our industrial society. The number of opportunities open to the semiliterate diminishes daily. Even to the literate and the skilled, continued learning is necessary to maintain their relative positions in the industrial process, to say nothing of personal development, growth, and advancement.

This increased concern with education could take a number of forms, including:

1. Facilitating, expanding, and broadening the activities of presently existing educational institutions, both public and private, at all levels.
2. Creating new learning centers, making them available to those who are motivated, regardless of where they might be.
3. Encouraging the pursuit of learning, as, for instance, by making all educational expenses deductible for income tax purposes.
4. Promoting the establishment and facilitating the functioning of scientific, engineering, and technical societies whose main function is to provide continuing information and education to their members and to the industry they serve.

There is, as is undoubtedly known, a considerable amount of literature on the subject under consideration by the Commission. George Terborgh's relatively new book, *The Automation Hysteria,* presents a well-documented story of automation and includes bibliographic references to many other writings on the subject. Charles E. Silberman's series of articles starting in the January 1965 issue of *Fortune* is another excellent discussion of the subject. Probably the best known, and possibly the most controversial of the many writings on the socioeconomic aspects of the situation is *The Affluent Society* by John Galbraith.

The magnitude and complexity of the problem is shown by the size of the grant given Harvard University by IBM—$5 million to finance a 10-year study of "automation, its effect on employment and its role in our dynamic economic system."

Evaluating the writings, the evidence, and the data presented for bias will, at times, be most difficult. The human emotions involved are going to make the job doubly difficult.

ASTME recognizes the immensity and the importance of the task assigned the Commission. While we do not feel that we are qualified to discuss the overall socioeconomic questions, we would, however, be very happy to study any specific questions or problems that are within our education or experience background.

STATEMENT

Prepared for the Commission
by the
Association of American Railroads
Washington, D.C.

Statement by the Association of American Railroads

The railroad industry appreciates this opportunity to express its views for the Commission's consideration, especially with respect to the fundamental importance of encouraging technological innovations and organizational improvements, such as mergers and operational changes, without which there could be no appreciable economic growth, increasing productivity, and rising living standards. This is an ancient truth which has been demonstrated over and over again in our economic development.

The railroad industry has been a leader in coming to grips with the associated problems of imperative technological change and its impact on railroad employees. As an industry that laid down its roots in the early days of the industrial revolution and whose major contours were shaped more than 50 years ago, we have been faced as few others with the question of whether we could indeed make the vast technological and structural changes needed to retailor railroading to the demands of this dynamically expanding and highly competitive modern era and, at the same time, solve the complex human, governmental, and financial problems associated with this great endeavor.

Despite restricted earnings and limited access to capital, the American railroads have managed to devote some $21 billion since the end of World War II to this reconstruction and improvement program, and we intend to do everything in our power to continue this vital national transportation program. The widely publicized work-rules-modernization movement is an outgrowth of this effort and, particularly, in the settlements worked out under the Arbitration Board decisions pursuant to Public Law 88–108.

Nevertheless, it must be recognized that there remain those who in their own immediate self-interest seek to maintain the status quo by resisting technological improvements and by preserving jobs that have been outmoded by the march of progress. While the reasons for such attitudes are understandable in terms of narrow and immediate self-interest, they cannot be allowed to prevail.

For your consideration in this regard, we commend as precisely to the point the following statements contained in the January 1964 report of the President's Council of Economic Advisers:

> Even if we wished to, we could not eliminate pervasive and continuous technological and economic change without remaking—on a much inferior basis—the whole fabric of our social and economic institutions. And we would not wish to. Its benefits are essential for continued economic growth, higher standards of living, and the elimination of poverty. Our objective should be to foster and encourage it. (p. 85)

Further, in summation of this issue, that report points out:

> Fears of technological advance are understandable on the part of those who feel its threat to their livelihoods. In the absence of wise and effective private and public action such fears are justified. But any comprehensive appraisal can lead only to the conclusion that the benefits of technical change—in the future as in the past—are such that public policy should foster rather than shun it. . . . (p. 111)

The essentiality and the widespread benefits of technological change are nowhere better demonstrated, we believe, than in the railroad industry, where there are so many opportunities for improved techniques and mechanized operations. Surely it can be said, for example, that the railroads now would be in disastrous circumstances, if indeed they could have survived at all in the competitive struggle for traffic, without the transition from steam to diesel engines with their superior performance and economy. It is no less obvious, and easily seen in retrospect, that railroad workers as well as the public generally would have been the heaviest losers had not such changes been made.

What may not be so readily appreciated by some is that the way must be kept open for such changes in the future if our economy is to continue to grow and become more productive. In the railroad industry, even now vast technological advances are taking place, to cite a few examples, in the adaptation of machine methods for the maintenance of railroad rights-of-way, in the mechanization and consolidation of shop work, in advanced communication and signaling systems, in the construction and operation of electronic "push-button" yards for handling freight cars more economically and expeditiously, and in the application of automated methods of data processing to cope with the mountainous volumes of paperwork involved in operating a modern railroad efficiently and in handling arrangements and records among railroads with respect to their interline business.

Some of these technological improvements are still in their comparative infancy and they, along with other breakthroughs not yet realized, must go forward in order that the resurgent railroad industry may be able to handle efficiently the increasing traffic loads of a growing and more productive national economy.

We would point out, however, that there is a less sanguine aspect of this matter. All too often some labor organizations, in the railroad industry and elsewhere, still bend their efforts to the retention of existing forces and jobs that have been outmoded by technological change or by greatly diminished demands for service, as in the case of some railroad passenger-train operations. In the legislative sphere, the railroads have to contend with a particularly objectionable example of such job-preservation policies in those States that still keep on the statute books provisions requiring so-called "full crews" which in their actual effect require excessive crew consists. On the encouraging side, it may be noted that certain of the States have recently repealed such ancient statutes, and in some others they have been upset in the courts.

Through collective bargaining agreements, also, some progress has been made in the revision of outmoded and wasteful work rules, but there is much that remains to be done and can be done by means of enlightened collective bargaining procedures. However, such progress has come slowly; witness the protracted struggle over the "fireman" issue in road freight and yard service which was dealt with after Congress acted under threat of strike, by the terms of Arbitration Award No. 282. Certain other long-existing "crew consist" issues were settled in subsequent negotiations, but only after President Johnson intervened.

We invite the Commission's attention to the inherent contradiction involved when union demands for everincreasing wages and wage supplements, such as greater retirement benefits, are accompanied by unrelenting opposition to the elimination of redundant positions which can no longer make any significant contribution to efficient production and may, indeed, subtract from it. In the railroad industry, as in the economy generally, increases in real income and in living standards can in the final analysis come only from improvements in productivity.

This is not to say, of course, that workers who are displaced by economic change should not receive reasonable transitional assistance by such means as retraining programs or severance allowances. But here the vital distinction must be made between the uneconomic perpetuation of jobs and the reasonable protection of workers and their families against hardships resulting from technological and economic changes. In the railroad industry, long-established protective provisions stemming from the Washington Agreement of 1936 make what are widely acknowledged to be generous allowances to employees displaced by coordinations, abandonments, mergers, and other changes which render certain jobs obsolete. The terms of Arbitration Award No. 282, noted above, also made very liberal provisions for the protection of firemen whose services were found to be no longer necessary.

In dealing with such matters, we believe it is important that protective provisions should not rely excessively on the slow processes of natural attrition, especially where a large part of the working lives of the persons involved is still ahead of them. In addition to the heavy costs that would be imposed upon industry, extreme reliance upon the attritional principle as a seemingly easy escape from the problem would entail a serious loss of human dignity and a waste of human resources that could not be justified on economic, social, or moral grounds.

STATEMENT

Prepared for the Commission
by the
Automobile Manufacturers Association
Detroit, Michigan

Statement by the Automobile Manufacturers Association

Technological Change and Employment in the Automotive Industry

General Statement

Perhaps nowhere in America are people more accustomed to change than in the automotive industry. This is a natural consequence of being a part of a dynamic industry which produces new models of a wide variety of cars and trucks each year. In order to serve the public and satisfy its appetite for quality products at attractive prices, the industry spends millions of dollars annually in tooling up for the new models. During each calendar year those in the industry experience the close of 1 model year, the annual changeover to new model production, and the commencement of a new model year. Tooling programs, equipment changes, conveyor line rearrangements, the introduction of new machinery, changes in methods and processes—these and many other activities take place during the annual model changeover or are scheduled to be completed at the time new model production begins.

Model changeover, of course, is not the only time innovations and technological change take place in the automotive industry. Changes of all types, including engineering changes in the product, changes in production methods, and changes in the equipment being used, are an everyday occurrence throughout the entire model year. As a consequence, everyone in the industry is accustomed to change as a natural, expected, and inescapable way of automotive life.

It should be apparent to anyone familiar with the industry that, over the years, the technological change in the automotive industry has been an evolutionary, not a revolutionary, process. It has been gradual and steady since the industry began. It has been an essential part of the business. It has been both a cause and a result of the impressive growth of the automotive industry.

In the automotive industry technological changes have been accompanied by expanding, not declining, employment. Since the start of the current economic expansion in 1961, for example, employment in the automotive industry has increased by almost 300,000. The demand for motor vehicles has increased tremendously since the industry began. Cars and trucks have been improved both by the addition of new features, such as power steering, power brakes, and air conditioning, and by changes in basic features, such as improved engines, suspension systems, and automatic transmission, requiring additional man-hours of labor. During the recent 8–year period of price stability in the economy, the industry has been able to offer the customer an improved car each year at virtually the same price.

Technological change has been a manageable process that has not displaced nor rendered obsolete overnight the skills of large groups of employees. At the present time, there is no evidence that a substantial change in the pace or the nature of technological change will occur in the automotive industry.

Past experience probably provides the best guide to the effect of technological change on future automotive industry employment levels and skill requirements. From that viewpoint, technological change has historically caused no drastic or rapid shift in the nature of employee skills required by the industry. The education and skills of the automotive industry's work force have improved gradually, and this may be expected to continue because such improvement is taking place generally across the entire country.

For the foreseeable future, as in the past, a large proportion of the blue-collar job assignments in the automotive industry will be ones that can be learned quickly. In any event, as in the past, any changes in skill requirements which do occur will no doubt be met primarily by training industry employees for the new jobs as they appear.

Employee Wages, Benefits, and Working Conditions

The improvment in the Nation's productivity, to which the automotive industry has contributed, has resulted in higher standards of living for automotive industry employees. During the period 1947–64, real hourly wages in the industry increased 57 percent. In addition, employees have been provided a part of the increase in their standard of living in the form of supplementary benefits, such as sickness and accident benefits, hospital and surgical expense coverage, life insurance, pensions, unemployment benefits, and longer paid vacations and more paid holidays. Moreover, technological progress has resulted in improved working conditions as automotive jobs have become substantially safer and more attractive over the years.

Technological Change and Employment Security

Management and union leaders as well in the automotive industry have recognized the desirability of technological change. Collective bargaining in the automotive industry has not been characterized by conflict over featherbedding, issues that have retarded technological advance and assumed major importance in collective bargaining in other industries.

For the past 15 years, automotive industry union contracts have contained the following paragraph which is indicative of the attitude of management and the unions toward technological progress:

> The annual improvement factor provided herein recognizes that a continuing improvement in the standard of living of employees depends upon technological progress, better tools, methods, processes and equipment, and a cooperative attitude on the part of all parties in such progress. It further recognizes the principle that to produce more with the same amount of human effort is a sound economic and social objective. . . .

In its labor agreements, automotive management has retained the right to introduce changes in products, tools, methods, and processes at any time. The industry has thus been free to introduce technological changes as rapidly as they become technically and economically feasible.

Changes in methods and in products are an everyday occurrence in automotive plants. This has been the nature of the business since the beginning of the industry. As a consequence of changes, jobs and groups of jobs have been eliminated and at the same time other jobs have been created. For over 25 years the companies and the unions have had an established, orderly, and fair way of handling such situations associated with both the elimination and the creation of jobs. This favorable environment has made possible gradual, evolutionary changes without sudden, major employment dislocations or shifts.

Any employment shifts attributable to technological changes which have occurred have not affected the security of large numbers of employees. The policies and procedures of the automotive industry have minimized the impact on employees of such dislocations as are from time to time caused by technological change.

Many of these policies worked out through collective bargaining have been incorporated in industry-labor agreements for many years. They have helped the industry and its employees adjust to technological change efficiently and with a minimum of human hardship. They help answer such questions as what wage rates are paid for new jobs and what happens when an employee's job is eliminated by a new process or machine or when a major operation is transferred to a new location or, as in rare cases, when a plant is permanently shut down.

These policies have successfully met the problems associated with technological change in the automotive industry for more than a quarter of a century. For that reason, a discussion of some of the main features of the industry's job and income security programs as they relate to technological change might prove helpful to the Commission.

Automotive Industry Programs, Policies, and Procedures as They Relate to Technological Change

The companies in the automotive industry have many programs, policies, and procedures which relate to technological change. As to those technological changes which affect employees and their rights, labor contract provisions have been worked out through collective bargaining with unions representing these employees. Some of these provisions have been negotiated to apply specifically to situations in which technological changes affect employee rights and job security. Others, though intended to apply in broader areas, are applicable as well when technological change occurs.

Dealing with Job Displacements

Displacements of employees which occur in the automotive industry as a direct result of technological change ordinarily affect relatively few employees at any one time. Although individual company seniority provisions differ somewhat in detail, they have all been characterized by a broadening of the base or the area in which employees may exercise seniority and thereby increase their job security.

Employees displaced are transferred in accordance with their seniority to jobs in the plant which they are capable of performing. These jobs are comparable in pay to their former jobs. In the automotive plants there are a wide variety of job assignments on which a great many employees are interchangeable. Accordingly, it is not difficult to locate a job to which an employee exercising his seniority can be assigned. This is particularly true in the case of longer service employees who have worked on numerous job assignments in past years. Therefore, it is a rare occasion indeed when a long service employee is unable to exercise his seniority and remain at work on a job he can do.

In cases where layoffs do occur in the automotive industry, whether as a result of technological change or any other reason, a number of procedures are available for the employee's protection. One of these is area hiring preference.

Under the area hiring procedure, employees laid off from one plant are given preference over new job applicants for employment at whatever other plants the employer may have in the area. The effect is to pool each company's work force in a given labor market area to enable employees to flow smoothly from plants where employment may be declining to plants where jobs are available as a result of increases in output or for other reasons. In Flint, Michigan, one General Motors multiplant community, employees may shift between 12 AC Spark Plug, Chevrolet, Buick, Ternstedt, and Fisher Body plants and warehouses. In the Detroit area, Ford employees may shift between 26 plants and Chrysler employees between 27 plants. Since 1951, over 30,000 Ford employees have been placed under the preferential hiring agreement covering the Detroit area. Laid-off automotive industry employees are also given preferential hiring treatment in new plants established by their employer.

Negotiating Wage Rates for New Jobs

Wage rates for job classifications have been negotiated between employers and unions in the automotive industry for over 25 years. This orderly method of establishing wage rates has been applied whenever job classifications were needed in a plant for which a wage rate had not already been agreed to by the parties. Thus, this method has been used whenever technological changes resulted in a new job classification being created. The process has become routine, with the management and union representatives having responsibility for establishing negotiated wage rates.

To set rates for new jobs placed into production which cannot properly be placed into an existing classification, management establishes a temporary job classification and rate. As soon as possible thereafter, management and the union negotiate a permanent rate for the classification. If management and the union disagree whether a new classification and rate should be negotiated, the dispute may be submitted to an impartial umpire for determination. The umpire may rule that the job properly fits into an existing classification or that it is a new job which fits no existing classification. In the latter event, the parties have the responsibility to negotiate a new classification and rate. The new rate and classification then become a part of the existing wage agreement.

Plant Closings and Transfers of Major Operations

The closing of a plant or the transfer of a major operation to another location is the best example of the full range of programs available to protect employees.

Whenever management decides to close a plant or to transfer major operations, the union is informed in advance and a memorandum is negotiated regarding the rights of employees affected. The protective programs can be and are as varied as the needs of the employees involved.

Employees who wish to continue their careers with the company and accept transfer to the new location retain full seniority and full rights under all benefit plans. To further encourage employee mobility, the transferred employees may be eligible for a moving allowance of up to $580.

Many employees may understandably wish to remain in their present home communities. If the employer has other plants in the area, employees will be given preferences over new applicants for jobs available in these plants under the area hiring procedure already discussed. While awaiting placement under this program or seeking work with another employer, employees can receive up to 52 weeks of supplemental unemployment benefits which, in conjunction with State unemployment benefits and earnings, if any, will provide approximately 62 percent of weekly earnings for a 40-hour week plus $1.50 a week for each dependent up to four. In addition, such an employee would be protected by fully paid hospital, medical, and surgical insurance coverage for up to 1 year.

If the opportunity for employment at another company facility in the area is unlikely, the employer assists the employees in finding jobs with other firms in the community.

Older employees can take advantage of the early retirement program. Under the flexible retirement age provisions of industry pension agreements, the normal retirement age is 65, the automatic retirement age is 68, and the early retirement age may be as low as 55. In the case of plant closing or transfers of major operations, special early retirement provisions are applied. These permit employees who are at least age 55 with 10 years of credited service to retire with unreduced life income benefits of $4.25 per month for each year of credited service. Such employees receive an additional $5.20 per month per year of service, up to a maximum of $130, until they reach age 65 or become eligible for unreduced Social Security benefits. After September 1, 1965, employees who retire prior to age 65 may also be eligible for a new supplemental allowance which can raise total monthly retirement income from the company up to $400 until they reach age 65.

Employees who do not transfer to the new location or who are not placed under the area preferential hiring procedure, and who are not eligible for retirement benefit, may be paid a separation allowance equal to as much as a full year's pay.

They will become eligible as early as age 60 for a deferred vested benefit under the retirement plan, if they had at least 10 years of credited service.

Thus, with transfer rights and moving allowances, area preferential hiring and supplemental unemployment benefits, early retirement, and separation payments and vested pension benefits, employees and their families are well protected when a plant closing or a transfer of a major operation is necessary for any reason, including technological change.

Training and Retraining

Just as technological change is an everyday occurrence in the automotive industry, so are the training and retraining activities which are carried on as a routine, normal part of doing business. The frequent changing of automotive industry job assignments means that the industry's retraining task never ends.

As jobs are changed and new jobs created, new employees must be trained and employees must be retrained in order to fill them. In most cases, the training required by individual employees is accomplished by brief periods of on-the-job training. The actual experience of an assembly plant going from a one-shift to a two-shift operation provides an excellent example. Over a period of 4 to 6 months, a total of 1,057 new hourly rate employees were hired. This group received 67,280 hours of on-the-job training or approximately 64 hours per employee. In addition, 73 hourly employees who were promoted to foremen as a result of the addition of the second shift received 19,050 hours of presupervisory classroom training. For the majority of these employees this represented between 6 to 8 weeks of intensive classroom training, plus 1- to 3-day assignments in the various departments.

On some occasions equipment changes are of such magnitude that more formal training is required, particularly for skilled employees. Such training may involve longer periods of time, classroom work, and instruction by equipment manufacturers.

During 1964, Ford had about 23,000 enrollments in various retraining programs. Of these, 13,100, or 57 percent, were by hourly employees. The hourly retraining activities included over 2,000 enrollments in various subjects pertaining to the production of steel by the basic oxygen furnace method, over 7,000 in the maintenance and operation of arc welding equipment and ultrasonic weld testing, and over 200 in the maintenance of a new pivoting pillar body buck. Also, in 1964, a 19-week electronics program in the maintenance of new automated forging equipment was established.

In GM, also, formal training courses in addition to on-the-job training are provided for hourly employees. In one GM plant with 2,400 employees, 22,981 hours of specialized training were given 838 employees in 1 year. The training ranged from 1-hour classes and safety lectures to teaching operators how to handle tape-controlled machines in courses that extended over several months.

The need for such highly skilled journeymen as electricians, tool and die makers, machine repairmen, and pipefitters is a never-ending one, and close attention is paid to apprenticeship programs and keeping them up to date with manpower requirements. The four major automotive employers have approximately 15,000 employees enrolled in apprenticeship and on-the-job training programs leading to journeymen status. Through cooperation with technical high schools and community colleges, apprentices receive advanced course work related to their apprenticeship programs in such fields as electronics, mathematics, physics, chemistry, drafting, tool and die design, metallurgy, hydraulics, combustion, operating engineering, and similar technical subjects.

Apprentices are paid for the hours of training in the plant and for the time spent in required classroom training. Their rates are increased in eight increments from a minimum of $2.70 per hour plus cost of living allowance to the regular journeyman rate for their trade as they satisfactorily complete the 4-year apprenticeship period. Tuition and registration fees for classroom training are paid by the companies, and a special payment is made toward the purchase of tools for the apprentice.

In addition to apprentice programs, several companies also use the upgrading method to develop skilled tradesmen. Qualified employees are given on-the-job training in skilled job classifications through the Employee-in-Training or E.I.T. Program. It provides the opportunity to attain journeyman status for employees who were unable to serve a formal apprenticeship but who have acquired the skill and ability of trained mechanics. Such employees are eligible to be reclassified as journeymen by agreement with the union after they have served in a particular skilled classification for 10 years.

As an incentive for voluntary education improvement, the automotive companies offer their employees tuition refund plans. Under these plans employees who satisfactorily complete college or other specially approved course work in their spare time receive a full refund of their tuition expenses up to a maximum of $250 a year. By participating in this program, employees may further their formal education.

Since the tuition refund plan was extended to hourly employees for the first time in the fall of 1964, no data are available on utilization. However, these plans have been available to most salaried employees for a number of years. In the major automobile companies in 1964, over 20,000 salaried employees completed college, postgraduate, or other specially approved courses under the plans. In some cases, employees who wish to leave work to continue their education full time may be granted leaves of absence for up to 12 months, with seniority accumulating during the leaves. Such leaves may be renewed for additional periods.

Summary and Conclusions

The automotive industry and its employees have shared in the benefits of sustained technological advance. This has been possible for four reasons:

1. Acceptance of changes as normal, continuing, and essential in the automotive industry with programs, policies, and procedures effectively protecting the interests of all concerned;
2. An orderly collective bargaining relationship with definite policies to protect employee interests and security;
3. Investment in better tools, machinery, and equipment, and by better organization and better management methods;
4. An expanding output which has created new jobs faster than old jobs have been eliminated.

New methods and new machinery have always been characteristic of the automotive industry. Because technological advance has been a continuing process rather than an intermittent, disruptive one, it has been accomplished with resulting benefit to the existing labor force and not at its expense. Since changes in the methods of production have been adjusted to as each was introduced, the individual adjustments required have been small.

Years of gradual improvement in work skills through on-the-job training and other programs have done more to enrich employee capability than any one program of massive retraining could have accomplished. Thus, the procedure of adjustment by employees has not been permitted to lag behind the pace of technological change.

Both management and the unions have recognized the need for technological change and have cooperated to develop policies and procedures to ease employee adjustment. An orderly procedure to establish new jobs and job rates has allowed employees to fill the new jobs without costly friction. Where greater adjustments have been needed, they have been accomplished within the framework of a family of policies designed to protect employees when jobs were threatened for any reason—seasonal fluctuations, business recessions, changes in consumer taste, or technological innovation. Plantwide seniority protects the displaced employee in his plant.

Preferential area hiring widens employment opportunities. Transfers and moving allowances encourage employee mobility. Supplemental unemployment benefits, separation pay, vested pension benefits, and placement assistance help employees find work with other firms with minimal financial sacrifice. Flexible retirement age provisions allow older workers to leave the work force and still maintain an adequate standard of living.

Expanding demand for the industry's products has been the greatest source of employment security in the automotive industry. Growth in output has enabled the industry to provide new job opportunities and to avoid layoffs which might otherwise have occurred because of technological change. In a vital sense growing output and improving technology have fed upon each other: Technological advance has allowed the industry to produce improved vehicles which have attracted customers and resulted in higher sales, while higher sales and output have enabled producers to introduce new equipment and processes and thus to improve their products. In turn, both growing output and advancing technology have made possible greater protection of employees from hardship that might otherwise have been the outgrowth of change.

Improvement in the standard of living, the expansion of employment opportunities, and continued economic progress in the country can be assured only so long as there is continued technological progress.

STATEMENT

Prepared for the Commission
by the
Bell Telephone Laboratories, Inc.
Murray Hill, New Jersey

Statement by Bell Telephone Laboratories, Inc.

Effect of Technological Change

In the past, the effect of technological change has been to enable fewer people to produce the required food, shelter, and other necessities of life, thus freeing labor and skills for the production of new things which we come to want or require. Everything indicates that the rate of technological change can become greater, and it is becoming greater in some areas. Sometimes, however, technological change is inhibited for various reasons. For instance, in New York City, union regulations inhibit the adoption of many practices in newspaper production which are effectively used elsewhere in the country. Sometimes restrictive governmental legislation inhibits change. For instance, the creation of a new entity for the provision of satellite communication divorced that art from the financial and technological support it might otherwise have received from existing communication companies, and so delayed satellite communication and will make it more expensive.

Worker Displacement

The area of worker displacement and related matters is outside of the writer's competence. It does seem clear, however, that new industries will grow up in areas where it is pleasant or economical to live and where it is economical to operate industries. Improved communication and transportation, together with our well being, have made our population more mobile, and advances in communication and transportation have also allowed a greater option in the location of industries. As people are freed from existing industries through automation they will and should move to other parts of the country in finding jobs in new industries.

Recent Technological Developments

Our technological developments in recent years have been of two types. One is technological developments in the civilian industries which produce wealth which both maintains our people and makes possible our expenditures for defense and space. The other area of technology is that in which a substantial part of our wealth is spent on defense and space. There is, of course, some interaction between these producing and consuming areas of technology, but they have really become quite separate. Thus, even when industries strong in the productive civilian economy do Government defense and space work, they usually do it through special divisions which are isolated physically and organizationally from the rest of the enterprise. Sometimes a company strong in the productive field (such as the Ford Motor Company) will set up a subsidiary enterprise (Aeronautronics in the case of Ford) which has as its sole objective Government contract work, and which has no relation to the technical problems of the parent company.

This division of our economy into two very different segments with very different requirements has been little understood. It has had profound consequences in the two technologies. In the technology of space and defense, promptness and performance are the prime requisites, and cost must conform to these. In the productive civilian economy, the primary requirement is that the product must be worth what it costs in the open market; otherwise it will not be produced. Thus, both management methods and technological practices in the space and defense segment of industry are inconsistent with the needs of the civilian segment of industry, and are largely nontransferable.

There is, of course, a large transfer in the opposite direction. Military and space technology owe the transistor, the solar cell, the digital computer, and a host of other things to the civilian side of the economy.

It is largely the Government which finances graduate engineering and scientific education, and this has pushed the universities in the direction of the spending rather than the producing side of our economy—toward the military and space. One of the most urgent problems is to direct the attention of scientists and engineers to the production of wealth.

Human and Community Needs

The local, State and national governments must meet some large-scale human and community needs, including defense, the provision of water and sewers, the provision of a highway system, and above all, education. Many human needs, however, and most new human needs are met through private investment. This investment can produce results only through new science and technology which meet human needs economically. Here the most effective ways the Government can help to achieve new technologies consistent with the civilian economy and human needs are to provide adequate education aimed at this end, and to tax and regulate in such a way as to allow an adequate return on innovation. A tax credit for industrial contributions in support of research in universities would help to direct educational institutions toward the productive side of the economy. I believe that it is apparent that recent tax cuts have stimulated productivity and have helped to lay a groundwork for innovation.

Preparing for the Future

Both management and labor have been backward in preparing for the future. Management, perhaps because of the economic and tax situation, has been unwilling to invest properly and wisely in research and innovation. Labor, instead of trying to find new jobs, has tried to hang on to old and unnecessary jobs. Government, both Federal, State and local, also sometimes stands in the way of progress rather than supporting it. Specific things which the Federal Government could do are:

1. Consolidate in both the Executive and legislative branches its various activities in old and fragmented fields of human endeavor. Thus, railroads, buses, and airplanes are all transportation. We won't make sense of transportation unless we are able to regulate, tax, or subsidize, and to legislate concerning transportation as a whole. We need to bring areas of science and technology closer together, not to cut them up in pieces. Unfortunately, Congress tends to hack science into small and, they think, manageable bits. For example, atomic energy has been set aside from the rest of science and technology through the creation of the Atomic Energy Commission. The writer believes that setting aside satellite communication from all other communication was another such harmful step. Traditionally, Congress has tried to protect us from bigness. What we need now is protection from inefficiency and disorganization.

2. As mentioned earlier, mobility is a requisite in adjusting to new possibilities and needs. Further, many of our social disasters come from lack of mobility, as in Appalachia and in the slums of many large cities. Sometimes the Government acts to fix people where they are through alleviating their most pressing difficulties, rather than trying to solve the problem by getting unneeded people someplace else, where jobs are. The writer does not know what specific legislation would help. This is a matter one has to treat case by case. This writer feels, however, that the subsidization of uneconomic living in uneconomic areas is a potential source of human and economic disaster.

3. It is obvious that the future will require better education. If this is to be effective it must be aimed at educating people who are capable of being educated to the degree to which they can be educated. For instance, it is a waste of time and money, and a process of human agony, if we try to educate for a demanding job a worker who has been displaced from a demanding job by someone more competent. Yet a lot of retraining effort has been spent on the out-of-work who have been replaced by the more competent. It would be far more fruitful to give further training to people who already have demanding jobs, but jobs which are beneath their ultimate capabilities. If people who are productively employed beneath their capacities were trained for better jobs, they would take better jobs, which always exist. There is always a demand for able and highly educated people. Then their former jobs would be open for the less capable men who should occupy them.

STATEMENT

Prepared for the Commission
by
Walter Buckingham
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Statement by Walter Buckingham, Drexel Institute of Technology

The Poverty and Unemployment Crisis

Facts About People Forced to Compete with Machines

Automation and technological change are among the causes of our excessive unemployment and poverty. In its broadest sense, automation is not new. French physicist and philosopher Blaise Pascal developed several "arithmetic machines" in 1642 and Denis Papin invented the automatic pressure valve in 1680. Automatic steering machines for ships were in use in the early 18th century and Oliver Evans invented an automatic, water-powered grist mill in 1784. James Watt's "flyball governors" were automatically controlling steam engine speed in 1788 exactly as they are controlling industrial diesel and gasoline engines today. An automatic loom, operated entirely from instructions fed to it on punched cards, was demonstrated by Joseph Jacquard in 1801. Charles Babbage demonstrated an "analytical engine"—the first practical automatic calculating machine—using feedback principles, in 1840.

Thanks largely to technology, our national economy is now annually producing at a rate of over $700 billion worth of goods and services. With this, our almost 200 million people should be the most prosperous in world history. In fact they are. But, at the same time, we have continued for over 10 years with abnormally high levels of poverty and unemployment.

Although poverty and unemployment are different things, the two are usually inseparable, breeding on each other. Some poor people are partly or fully employed at near-starvation wages. Also, some unemployed people have savings or other sources of income. But the poor and the unemployed overlap enormously and tend to be afflicted with the same problems. Their problems, whether we like it or not, have become the most crucial social and economic problems of our times. Poverty and unemployment, in large part, foster economic, social, and political irresponsibility, indifference, immorality, and even revolutionary extremism. These include juvenile deliquency, child desertion, robberies, assaults, prostitution, illicit liquor operation, alcoholism, mental illness, murder, racial violences, and rioting in general.

Poverty and unemployment are not only costly to the poor and unemployed but to all of society. Unemployed or poverty-stricken people are handicapped people. Yet, since fairly decent clothes can be mass-produced rather cheaply in this country most of these poor or unemployed people are invisible in the streets. But though fairly decently dressed, they are not decently fed, housed, educated, or medically treated.

Effects on Clerical and Industrial Workers. In 1955 there were only a few dozen electronic computers in the United States. There are now over 10,000 being produced every year. The effect that this revolutionary technological change has on people is the important thing to know, if we are to prevent the disadvantages without curtailing the advantages. The Bureau of Labor Statistics estimates that the average computer abolishes about 35 clerical jobs altogether. This is roughly 25 percent. It also changes the kind of work for about 100 other white-collar workers. This is most of the rest. Assuming 10,000 computers manufactured every year, this multiplies out to 350,000 clerical jobs abolished annually, with over a million more jobs requiring retraining. This estimate is probably conservative, since the computer manufacturers themselves predict that computer output will soon double.

We now have some computers that can replace people with a high school diploma. Some have speeds up to 3 million operations per second. In three-tenths of a *millionth* of a second, some computers work a mathematical equation or tell another computer exactly what to do. A famous mathematician was asked how this could be explained. He replied that if an average person stood on the equator and took one step every time he was told to do so by the computer he would (theoretically, of course) walk around the world in less than one-tenth of a second. This is faster than the speed of light, which is 186,000 miles per second.

Some legal firms are now using computers to summarize laws and court decisions and seek out precedents and previous rulings. Before automation this required vast amounts of preparation in every case. A computer demonstrated at an American Bar Association meet- performed, *within 10 minutes,* more than 7 man-hours of research, analyzed 400 tax laws from 50 states, developed complete case citations, and began typing out a full text of all the material. A New York law firm has a computer which can search 120,000 cases in 1 minute at a cost to customers of $100 per year plus $20 per inquiry.

There will soon be law libraries around the country using computers to store and digest information. It is predicted that lawyers will soon be able to get all the information on laws and court decisions they need merely by dialing for it, much as we can now dial a certain telephone number for the correct recorded time of day.

The banking industry once employed a large number of inexperienced high school graduates as machine bookkeepers. The Magnetic Ink Character Recognition machine has now made this unnecessary. A large New York bank that put in a computer reported that in 1 year it hired 144 machine bookkeepers, 115 the next year, and in the following year, when the new equipment was fully installed, it hired none.

In a similar case in California the greatest effect was also felt by the "employables" seeking employment rather than the employees. Before computers were installed, one large financial firm hired over 100 experienced clerks annually. After automation, no one was fired but only 10 new people were hired each year, although the volume of business had increased enormously.

Increasing needs for clerical workers in business and government have so far more than offset clerical unemployment due to automation. The result has been that clerical job opportunities have continued to increase. But the effects of automation are still clear. A Bureau of Labor Statistics study shows that the increase in employment of clerical workers in companies using data processing equipment is less than half the rate of increase in companies where such systems have not been installed—7 percent against 15 percent, in fact.

Mushrooming technological changes have had a much more serious effect on factory jobs than office jobs. While automation has increased factory output enormously, the total number of production workers has actually declined. The number of workers in factory production in the United States decreased from 40 percent to 30 percent of the labor force in a recent decade, while overall production was increasing about 45 percent and the population increasing 20 percent.

In the manufacture of electrical appliances, employment declined 50 percent in 8 years while production was increasing 53 percent. In the chemical industry, employment rose a little over 1 percent in the same period in which production was increasing.

There has been a general opinion that any decline in factory jobs in automating industries would always be offset by increasing opportunities in the industries that make the machines. Yet, even in the manufacture of automation equipment—the "instrument production" industry—employment declined 15 percent (over 35,000) in 7 years. In the last 50 years, employment producing metalworking machines increased by only about 10,000 workers.

Even employment in the production of nonconsumer machinery, which rose at about 12,000 a year from 1900 to 1930 and 80,000 a year from 1939 to 1947, remained about constant until 1958 (while investment in machinery hit new records) and has fallen steadily ever since.

Effects on Specific Groups. There are many reasons why the general public has not yet recognized the seriousness of this problem.

First, the official rates of unemployment are undoubtedly on the conservative side. For one thing, part-time employment, underemployment of people working in skills below their abilities, and those who have given up seeking jobs are not fully considered. The part-time employed included an estimated 1.3 million people who are not counted as unemployed if they work as much as *1 hour per week.*

Expert studies show that we are measuring only the part of the iceberg that is above water. Many people have been out of work for so long that they have given up hope and are no longer looking for work of any kind. Consequently, they have lost all motivation for a better life. These people are not officially counted as unemployed, although most of them would gladly accept work if it were available. Including these, Dr. Charles Killingsworth, a national authority in this area, has estimated that total unemployment has been about 8 percent for many years. The famous Swedish economist Gunnar Myrdal, in his book *Challenge to Affluence,* estimates American unemployment at 9 percent for more than 10 years. The United Automobile Workers estimates true unemployment at 9.7 percent for the last decade.

The evidence of "invisible unemployment" is very clear. When jobs are available, or when employers are willing to train unskilled workers, or if they are less demanding about such things as age, race, or national origin, most of the unemployed or part-time employed have responded favorably to the opportunity to work. The conservative Federal Reserve Board has estimated that over 2 million people not now seeking work, and, hence, not counted as unemployed, would be at work or seeking jobs if overall unemployment were reduced to 3 percent. In Europe the number who seek work has grown enormously with low unemployment rates.

Second, the underemployed are estimated to be as much as 25 percent of the labor force. These include several million people working at jobs beneath their abilities, about 5 million women who would like jobs, 2 million part-time workers, and over a million farm workers who stay on the farm because there is no work other than this for them. Furthermore, many poor families are headed by retired people or mothers with young children. These are classified as "outside the labor force" and, hence, not considered unemployed. Nor are, say, coal miners who do no bother looking for another job when they are laid off, as they know no other jobs are available within traveling distance.

Third, there is labor displacement. A leading business executive estimates that the rate of disemployment, or "silent firing," is 40,000 persons per week, or over 2 million per year. Silent firing refers to those who are never hired because their potential jobs were eliminated by technology. It is true that the demand for professional people, such as scientists, engineers, and teachers, has exceeped the supply, but all of the professional people put together are only about 11 percent of the labor force.

The rate of labor displacement has increased. From 1947 to 1957 the total number of nonfarm employees, both clerical and factory, increased at the rate of 2 percent per year. But, since 1957 this growth rate has been more than cut in half, to less than 1 percent per year, or only about half the rate of population increase.

Unfortunately, displacement of labor in industry tends to reduce wages in the service trades, as the displaced industry workers move toward service jobs, vastly increasing the supply of labor without any corresponding increase in the demand for services. To make matters worse, there is ample evidence that automation is affecting some service trades almost as much as the mass production industries, so there appears little hope of creating any large number of jobs here to offset the decline in manufacturing.

Fourth, over 8 million factory workers are working overtime while almost this many are unemployed, underemployed, or only part-time employed. Unfortunately, it is often cheaper to pay overtime than to hire new workers. This is especially true in industries with seasonal demand. So, we have an economy of paradoxes. With record high levels of employment, production, profits, and gradually rising prices, we simultaneously have high and growing levels of unemployment and poverty.

Fifth, long-range unemployment has increased. The aged, the sick, the migrants, the minorities, the children, and the students are becoming an increasing burden on society. As medicine improves, more people are kept alive, even though often in conditions of chronic illness and economic dependency. Furthermore, continuing high birthrates are giving us a large proportion of children, and, hence, an unusually large student generation. Schools, universities, mental hospitals, nursing homes, old peoples' homes, and other refuges for the economically dependent will soon be impossibly overcrowded, and their expansion and maintenance will be a real burden on the society unless positive action is taken to prevent it.

Sixth, economic growth has not kept up. A United States Labor Department study of 36 of our major industries, employing nearly 30 million workers, shows that employment was expected to continue to decline in 15 of these industries. The ratio of employment was uncertain for 7 major industries, and the employment outlook was favorable in only 14 of the 36. Those expected to decline drastically include aerospace (of all things), bakery products, soft coal, crude oil production and refining, natural gas, dairy products, shoes, foundries, all kinds of wood products, meat, liquor, railroads, telephone communications, textiles, and others.

Seventh, we have not even kept up with theory. Full employment was defined by Sir William Beveridge in his classic book *Full Employment in a Free Society* as

> having always more vacant jobs than the unemployed, not slightly fewer jobs. It means that the jobs are at fair wages, of such a kind, and so located that the unemployed can reasonably be expected to take them; it means, by consequence, that the normal lag between losing one job and finding another will be very short.

According to this denition, we have been far from full employment for a long time.

Who is Most Vitally Hurt? Mixed with the so-called "affluent society" and the "economy of opportunity" in which we live is an enormous economy of frustration for millions of Americans. We in the United States, with only 6 percent of the world's population, have almost half of its wealth. Yet these figures overlook how the enormous resources are distributed. Mixed with our obvious abundance and increasing production and profits is a widespread and deep-seated cancer of poverty and unemployment.

For many years, about one-fifth of all American families (with an average of almost three children) have been unemployed or earned under $3,000 per year. Another fifth have lived on the verge of poverty, with only a slightly higher income and almost no economic security. These add up to nearly 80 million Americans living in, or on the edge of, poverty. Of these, over 12½ million Americans, or about 7 percent of the population, live in what is defined as "utter destitution," meaning they are in the lower half of the income bracket of those already in poverty.

Specific cases are more dramatic. One-half of all of our young men in the prime of life are being rejected by the draft for physical, emotional, or educational defects. These handicaps are often traced to their poverty-stricken backgrounds. About two-thirds of all hired farmworkers earn under $1,000 a year. Four-fifths of the elderly who live alone also receive $1,000 a year or less, while two-thirds of the elderly families receive under $3,000 a year.

The President's Council of Economic Advisers reports that those people classified as living in poverty include almost half of all nonwhite families, half of the families headed by people over age 65, or headed by women, and half of all farm families. Nonwhites are 10 percent of all families but make up 22 percent of the poor. Southerners, in general, are 30 percent of all families but make up 47 percent of the poor. Seven percent of our families live on farms but they make up 16 percent of the poor. A tenth of all families are headed by women but 25 percent of them are poor. Over a third of all families are headed by someone with less than an eighth-grade education but they make up 60 percent of the poor. These percentages add up to more than 100 percent because the groups overlap.

According to the National Policy Committee on Pockets of Poverty, the formula for poverty and deprivation is to be any one of these:

Be nonwhite.
Belong to a family with no earners.
Belong to a family whose head is a female.
Be a male aged 14 to 25, or over 65.
Have less than eight years education.
Live in a rural farm area.
Belong to a family with more than six children under 18.
Live in the South.

Most of the poor tend to stay at the bottom. Born in slums and having poor diets, they are physically in bad health. They are the last hired and the first fired from most jobs. Under such conditions, these millions of Americans can look forward to getting little return from life. This cycle breeds on itself, leading to everincreasing unemployment and poverty. Over $4 billion is paid in relief to these people every year, for which no work is received in return. This is in addition to the unemployment compensation paid to others. New York City alone spends half as much money on welfare and correction for people under the age of 25 as it spends on all education. The urban slum problem is far worse than the farm problem. The movement to the suburbs has created a new form of segregation based on levels of income, since most unemployed workers live in slum apartments in the central city.

Studies made by the U.S. Department of Health, Education, and Welfare go far toward explaining the impact of the majority of the population in the world's richest nation getting richer while a very large minority does not share in this. For example, the principle case for the trend toward more public health insurance is in the penalties suffered by the poor and unemployed through inadequate medical care, poor diet, inadequate housing and bad health habits. A lack of adequate prenatal care has long been one of the major causes of mental retardation, and a recently estimated increase of a million mentally retarded children in 10 years is based almost entirely on preventable poverty.

There has also long been a much higher prevalence of chronic illnesses among the poor. Of those people coming from families with incomes under $2,000 per year, over one-fourth have chronic illnesses whereas only 1 out of 13 in the $7,000 per year and up income groups are so afflicted. Those people who earn less than $2,000 per year have 6 times as much mental disease and visual impairment, 5 times as much arthritis and rheumatism, 4 times as much high blood pressure, and 3 times as much heart disease as those in the $7,000 and up income bracket.

The reason for these inequalities is that when medical or surgical treatment is required, consideration is normally given to the patient's economic condition. People coming from families earning over $4,000 per year have a 40 percent greater likelihood of having an appendix operation than a person from a lower income group. Many cases have been found where the decision of a physician to operate was based on the patient's ability to pay or whether he had health insurance. Three-fourths of our entire population have partial health insurance, but only one-third of those with incomes under $2,000 have any coverage.

Low-income groups cannot afford preventive medical care. One-third of the children in higher income brackets are seen by a pediatrician once or more every year, as compared with one-tenth of the childen from poor families. Furthermore, children from higher income families see their dentist 5 times more often than children from poor families.

Results of Poverty and Unemployment

A society with our value system cannot expect to build the truly great economic and social system now possible. Although we are the world's richest nation, we have not divided our wealth and opportunities democratically. For example, since 1920 expenditures on technical research and development have risen 20,000 percent, or 200 times, while educational expenditures rose only 12 times. No wonder our economy is out of balance.

In the 1960's over 26 million additional young people must have jobs. This is more than a 40 percent increase over the previous decade. If this trend continues, over a million-and-a-half teenagers will be on the streets by 1970—more than the present population of Boston, San Francisco, or St. Louis. Many parents have given up hope of a better life for their children, as evidenced by the fact that the rate of promotion from grade-to-grade among school children of families on relief is far below the national average. Of those who have completed high school in some States, it is actually easier for most of them to get into college than to get a job, except that they cannot afford college.

Edward Denison of the Brookings Institution has summarized four major domestic disadvantages which result from excessive unemployment. First, it discourages investment and research into new technology, which are two of the most important causes of our much needed economic growth. Second, it discourages workers from moving out of depressed areas and off farms, where they are either unemployed or underemployed, and seeking better jobs in new industries. Third, it increases union resistance to management's attempts to reduce wasteful labor practices, which increases opposition to more efficient production methods, including laborsaving machinery. Fourth, the high rates of unemployment lead to demands for higher tariffs to protect both industry and labor against goods produced more efficiently in foreign countries, therefore tending to hold up price levels at home.

In this country we spend nearly 10 times as much on liquor as we spend on books. We spend 3 times as much on chewing gum ($350 million per year) as on educational scholarships. The American public needs to know how many dollars are being spent in the country on such luxury items, as contrasted with the small fraction of this amount spent on retraining, social welfare, and other programs which could help the poor and aged. Smug moralisms from the few who are fortunate actually do much to prevent breaking this cycle.

We must train people to work for themselves or we will have to support them out of profits and taxes. The only economically sound thing to do is to think in terms of capital investment in people.

Young People. The problem is more serious when it is examined by individual groups. For example, the unemployment of teenagers in general has long been over 15 percent; Negro teenagers, 30 percent; and residents of so-called depressed areas, from 50 percent upward. Over a million young Americans between 16 and 21, although they should be going to school, working in factories, or serving in the armed forces, are doing none of these. As school dropouts, between 5 and 10 million American young people now face a future for which they are not prepared. There is no constructive place for them anywhere. No wonder they are our "angry young men." Since they are both out of school and out of work, they are especially bitter as they look for jobs that do not exist. They are often refused a job due to lack of experience, while at the same time they cannot get experience without a job.

Yet, the demand is there. In one major city, over 2,000 youths in 1 week registered for training, retraining, or any other way of winning a new lease on life. Many more are expected. Not one of the 2,000 knew what he wanted to do. He just needed help. The U.S. Secretary of Labor says we have an "outlaw pack" of over 3½ million of these young people who cannot find jobs. The cost of this to the Nation is over $1,000 per person every year in welfare and unemployment benefits alone, not counting the production lost by their unemployment or the cost of their possible crime and destructiveness. (Seventy percent of the recent crime increase has been in the 15-22 age group.) For an investment of $1,000 to $3,000 each for these outcasts, we could pull every girl or boy back from poverty, unemployment, and ignorance. The total cost to the nation of 1 year's unemployment for one person exceeds the total cost of 12 years of education. We spend more per person on prison inmates than on retraining our unemployed.

More than twice as many underprivileged

children drop out of high school as those otherwise classified. Over 40 percent of all farm families in the United States are poor by national standards and half of them live in the South. There are an estimated 16 million children of the poor who, when reaching age 16, are 3 times more likely to quit elementary or high school as those whose parents earn over $5,000 per year. A sample group of these dropouts, half of whom had been forced to quit school to support their families, showed almost half of those who failed to pass the basic intelligence test came from families of six or more children.

These unfortunates can expect, at best, part-time or insecure employment in low-level, low-wage jobs for their entire lifetime unless prompt, positive, and major action is taken to save them. If such action is not taken, they can look forward to a life of poverty for themselves and their families. As said earlier, we might expect it if these "rejects" eventually resort to lives of crime. There is no doubt that this unemployment is a major cause of race riots, as unskilled whites and Negroes compete for jobs that are rapidly disappearing. Dr. James Conant calls this problem "social dynamite."

The children of our poverty-stricken people may be able to work in the many new industries, which are being created so rapidly, if we rise to the challenge of educating or training them. A serious problem is that most of the parents of these children also need help of a positive nature. Although private industry has done a good job in this area, this is not nearly enough. The Federal, State, and local governments will have to provide more help where private industry or labor unions are not planning to reeducate or retrain.

Older Folks.—Second, at the other extreme, are the millions of unemployed or part-time employed in the so-called "older groups," which often means over 40 years of age. This leaves well over half the adult lives of millions of people to probable unemployment or poverty. There is a tragic loss through the waste of the abilities of these millions of people. We do less than any other industrialized nation in the free world to give our youngest and our oldest citizens a chance for dignity or even minimum economic security.

There are about 10 million aged people in the United States who are unable to find work to enable them to afford the minimum standards of living. When the Murray Body Company closed down, putting 5,000 people out of work, the so-called older workers (over the age of 45) were out of work an average of 6 months (compared with 3 months for all workers) and 82 percent used up all their unemployment compensation before finding other, often lower paying jobs. Most of those over 60 years of age never found another job and had to retire into dependency on others or social security.

There are now over 7 million Americans over 75 years of age. Yet, many firms will not hire employees over 40 as this age is considered "too old to work." But Einstein, Churchill, and many other great leaders made their historic contributions so late in life that they would have long since been retired if they had been in private business. Government statisticians estimate that there will be 9 million people over 75 by 1980 and if present conditions continue, most of them will be in the worst imaginable poverty. These millions are not only unemployed and poor—they are tormented by isolation and loneliness; they deserve jobs, if they are able to perform them and want them, and the best of medical care and human friendship.

Many suggestions have been made concerning what to do with our increasing millions of older people. These include programs for such things as better housing, changing our philosophy about our aged, who are very often maintained at minimum survival levels, medical care for the elderly, and abolishing compulsory early retirement for qualified workers, many of whom find no incentive to live after retirement.

Negroes. Third is the growth of our Negro population, in total, as well as relative to whites. More important is the Negro's recognition of his economic, as well as political, rights as an American citizen. As a result, the job hunt has increased more rapidly for Negroes than for whites. Although most Americans have known that Negroes are not fully sharing with whites in economic life and opportunities, the U.S. Labor Department has revealed that a startling gap in both quantity and quality exists and that it is widening in every field. It is true that a few Negroes hold significant jobs but this is not the overall picture. The expansion of Negroes into higher jobs has not kept up with their overall population growth or even with their education. In 1951 the average male Negro worker earned 62 percent as much as his white equivalent. Now it has fallen to about 50 percent. Unemployment for nonwhite teenagers has increased 60 percent since 1955—double the 30 percent increase for white teenagers.

In most industries Negroes are still the last hired and the first fired. This has caused many of them to be discouraged and drop out of the labor market altogether. Among white college graduates, 21 percent end up as managers, while only one-third, 7 percent, of all Negro college graduates ever get into management. So say Labor Department studies.

Furthermore, while a white high school graduate can look forward to becoming a skilled craftsman or white-collar worker, most Negro high school graduates end up as janitors, redcaps, or in other unskilled jobs. This, no doubt, is the reason so many of them drop out of school to take any job they can get. Racial discrimination in employment, education, and training is an unnecessary waste of our most important natural resource. We cannot expect to solve our nationwide civil rights crisis with the percentage of unemployment and poverty that exists at this time. Most, if not all, of the disturbances involving Negroes are based as much on their excessive unemployment and poverty as on any denial of their civil rights. What can be said of Negroes is also true for other minority groups. Well over half of all American Indian families and over one-third of all Puerto Rican and Mexican-American families earn under $3,000 per year.

Depressed Area Residents. Fourth, we have literally hundreds of bleak areas with almost complete unemployment or excessive poverty. Many of these are within blocks of the capitol buildings in nearly every State and the District of Columbia. They are just out of sight of most of our nationwide expressways. The people in these areas, representing a large percentage of the Nation's population, are, for the time being, politically weak. These unskilled and unschooled unemployed people are not only among those most in need of help but they are least likely to get it. For one thing, they tend to resist help and resent being called residents of "depressed areas." Yet, their problems are most crucial. Less than half of the West Virginians, who have spent their lives until recently mining coal, have found new work and almost all of the new jobs have been at lower skills, and, hence, lower wages.

Most of these people do not vote or belong to labor unions. Much of the labor and welfare legislation designed to help them has primarily benefited the middle third of our population. Even social security insurance is not available for many of these unfortunates. For at least a fourth of our Nation, the situation is getting worse, not better. Nearly a third of these were unemployed 4 months or longer. These millions of poor or unemployed may seem invisible or unorganized but they exist and could conceivably take the law into their own hands.

Other Unfortunate Groups. Many others are suffering from unnecessary unemployment and poverty. One group is women. The number and percentage of women entering the labor force is increasing rapidly. Over half the women in the 45-54 age group are working or seeking work. This percentage has been rising rapidly and steadily for many years. Well over half are now married. The most expert predictions are that there will be an increase of about 48 percent in women workers in a decade, compared with an expected 15 percent increase for men. Millions of people are employed in dead-end jobs that are fast disappearing. These include such people as migrant farm laborers, subsistence farmers, meter readers, bookkeepers, messenger boys, and elevator operators. Many more Americans are employed in status quo type jobs, mostly in manufacturing, where the demand for the products is still increasing so as to require about the same number of employees despite continuing automation.

People in these groups, such as migrant laborers, subsistence farmers, and unskilled domestic servants, are in poverty even though they may be working full-time. The fact is that only about one-tenth of migrant workers have full-time employment. While we have a record employment level of over 70 million people, over 15 million of these are out of work part of the time every year through no fault of their own.

Finally, there are many areas where there are labor shortages, but most of them are in the service industries, such as medical, legal, educational, and research jobs. All of this means we will have to prepare ourselves to live in a society in which practically all jobs will be in the services.

Explosion in Technology

Machines that once did away with horses now do away with people. It took two-thirds of a century to develop the electric motor. Following this, one-third of a century elapsed while vacuum tubes were being developed. Then it took 5 years to produce the solar battery and only 3 more years to produce the transistor. This rapid technological growth destroyed millions of jobs but, fortunately, during most of this period, new jobs were being created as fast as old ones disappeared.

Times have now changed. A leading manufacturer of automated machinery recently said automation "is definitely going to kill more jobs than it makes" and added, "What we need to do, therefore, is work out methods for using constructively the human labor we are setting free." Unemployment and poverty have many different causes which must be treated separately. Furthermore, care must be taken that the treatments are consistent with each other—one must not tend to work against another.

Recent large employment decreases have been found by the U.S. Labor Department to have occurred in industries with small productivity gains as well as those with large gains. In the first case, the result was a decline in both employment and output. In the second case, the immediate effect was a decline in employment and an increase in output. This would seem to indicate that excessive unemployment cannot be blamed entirely on automation, which increases productivity, since equally great increases in unemployment occurred in the non-automated industries which, consequently, had small productivity gains.

Manpower policy is concerned mainly with the equalitative problem. But at present, with demand so far short of the capacity of the economy, it is impossible to determine the size and nature of the qualitative problem. This accounts for the debate now going on among economists. Some argue that present unemployment is largely "structural"—resulting from the inability of workers to fill jobs that are available because they lack the necessary education or skills or because they live in the wrong places.

In this era of rapid change, any industry can decline almost overnight if it fails to keep up-to-date, or even ahead of the times. If any area of the Nation, or the total Nation itself, can hope to compete successfully with the rest of the world, there is certainly no longer any doubt that technical skills of our people and basic aptitude for training and constant retraining are crucial.

More important than technology itself is the astronomical rate of technological change. Many of us think in obsolete concepts in appraising the recent accelerated changes of technology. For example, the Queen Mary can transport 1,500 people each way between the United States and Europe in 15 days, but 1 jet plane can carry the same load in the same period, making 15 round trips, carrying 100 passengers each way.

One generation now sees more technological change than occurred in all previous history. People moving West only four generations ago used the same transportation as the Children of Israel used to leave Egypt. Now it is possible to fly around the world commercially in the time it took our pioneers to go 80 miles. Ninety-five percent of all the scientists who ever lived are now alive and active. As one worker put it, "The future is closing in on us faster than ever before."

Economic Costs. The unemployment of machines and natural resources represents only a temporary loss of production to the economy, since they can be used later. But the unemployment of persons is the greatest loss in many ways. First, depreciation of human beings is primarily a function of time, not use. The loss of production through idle human time can never be recovered by extending the life of the unemployed person, as is the case with many machines. When people are out of work the loss to the Nation is far greater than when only machines are idle. Many machines have a certain possible total production, whether they are employed all the time or on and off. This is not true of people. Many people die sooner when they are forced to retire or are largely unemployed and have no hope without the stimulation of something constructive to do. Furthermore, skills and talent deteriorate during unemployment, requiring extensive retraining to restore them, if it is at all possible.

The Labor Department estimates that $600 billion worth of good and services have been lost to us through involuntary unemployment in the last 10 years. What could we have done if we had used our labor resources fully? First, we could have doubled payments to the 15 million Americans now on social security. Second, we could have wiped out many slum areas by the construction of about 9 million homes in the $15,000 class. Third, we could have built about 1,000 badly needed hospitals with approximately 900 beds each. Fourth, we could have doubled the construction of water systems, sewage plants, parks, and highways. Fifth, we could have added about 400,000 badly needed classrooms for schools. Sixth, we could have increased the salaries of all American teachers by an average of $1,500 per year. Seventh, we could have given $2,000 scholarships to 3 million college students in need of financial help. Eighth, we could have doubled the necessary aid to our foreign allies without increasing the national debt. Finally, long periods of full employment cause people to leave safe, but unproductive, low-wage jobs and take jobs where they can contribute more output and receive more money for it.

Recently, the Secretary of Labor revealed that in 1 year we wasted more man-hours through involuntarily unemployment than were lost through strikes in the last 36 years. In the last decade alone, we lost forever, by unnecessary unemployment, 25 million man-years of production. This cost, in badly needed products and services, as noted previously, was at least $600 billion. In addition, there is no way to calculate the loss to the Nation through the number of people who, of necessity, had to accept employment at below the level of their abilities. Many others were forced into part-time employment or early retirement and the goods and services these people might have produced have been lost forever.

We have been more concerned about price stability than full employment because price increases affect everyone, whereas unemployment affects only a minority, although in this case a very large minority. The fact that unemployment has been accompanied by small price increases suggests that we may no longer have a choice between the two.

Psychological Effects. In addition to economic costs, the psychological effects of unemployment lead to low morale, despondency, and often a shorter, less productive life because of enforced idleness. For example, the number of Americans who lose all of their teeth is in direct proportion to their poverty. Also, the number of sick or ailing people who keep the corridors of our charity hospitals full is related directly to the levels of unemployment and poverty.

The greatest irony is that today it costs more to be unemployed or poor. School is compulsory so children must have clothes. We have little decent public transportation so a family must have a car. Rents are higher per person in slums than almost anywhere else. The poor tend to pay the highest prices and get the lowest quality of everything. Forced, for the most part, to live in crowded city slums, they are more lonely and depressed than ever.

Formerly, in poor countries, most people were accustomed to hunger, illness, poverty, and an early death. They accepted this misery as inevitable. Today the opposite is true. In the same countries, now called "developing" rather than "underdeveloped" or "poor" as before, there are demands for almost instant improvement based on knowledge of high living standards in the advanced countries, but ignorance as to what is necessary to achieve these standards and how long it must necessarily take.

In countries such as the United States and those of Western Europe, where the majority of the people live well above minimum living standards, there is no good excuse for the denial of opportunities to the poor and unemployed. Consequently, these conditions tend not to create apathy and irresponsibility, but frustration, anger, and sometimes violence. These are often the only forms of escape from reality that these unfortunate people know how to pursue.

Inheritance of Poverty. About two generations ago society looked on poverty and unemployment as crimes. The poor or unemployed were considered morally unfit and defective in character. They were suppressed if not actually punished. Those physically or mentally disabled were put out of sight as possessed of the devil. A few people still hold to these archaic ideas.

A few years ago, a group of miners were entombed in one of the Kimberly diamond mines in South Africa. Surrounded by unlimited riches, they slowly died, starving for food, thirsting for water, in need of medical assistance, and deprived of spiritual comfort. The diamonds were worthless to them.

Too many of our people still believe that the unemployed or poor have, unfortunately, chosen to be born into the wrong families, or races, or live in the wrong areas. There is also a small, but highly financed and highly vocal, minority in this country preaching that unemployment and poverty are due to unwillingness to work. For example, they oppose all help to the distressed unemployed or poverty-stricken millions. This minority is led, in large part, by people who have never had to pay a doctor's bill or been required to take the risks involved in getting and keeping a job in our highly competitive market. Many of them inherited great wealth and cannot seem to understand why everybody has not had the same advantage. This kind of thinking leads to the incorrect, illogical theory that unnecessary suffering for these people is their own fault.

There is no proof that the conditions of excessive unemployment or poverty are due to low intelligence, lack of ambition—or God's judgment—as some would have us believe. The poor are as intelligent as the rich and, if given equal education opportunities, will lead a productive life. Nor is lack of initiative an excuse for unemployment or poverty. How can we explain the plight of 11 million children who are victims of depressed areas or automation layoffs, and obviously have no control over their fate? We cannot blame it on God's judgment. If we did, His punishment would seem to fall on those who have sinned the least. Official unemployment has been about 5 percent, or over, for more than 10 years, whereas unemployment for those in age group 21-24 has been 19 percent, and for those 16-21 it has been 15 percent.

Continuing unemployment leads to a perpetuation of inherited poverty with all its necessarily attendant welfare expense. These intangible costs are difficult to measure, but a country that prides itself on the great values of individualism is certainly not healthy when it has millions of citizens who do not share in its opportunities. If we do not consider human values, we must realize that not only our world leadership but our Nation itself is at stake.

STATEMENT

Prepared for the Commission
by the
Building Service Employees' International Union
Washington, D.C.

Statement by the Building Service Employees' International Union

The Building Service Employees' International Union—an organization composed of approximately 335,000 men and women working in service industries and in service occupations—has been intensely concerned with job loss resulting from automation in the entire period following the end of World War II.

While our organization recognizes the need for progress and the benefits to the entire Nation that accrue from many kinds of progress, it has been greatly concerned with the fate of individual workers who have lost their jobs through automation, with the possible effects of automation upon wage levels of members and similar workers, and with the effect of job loss upon the economy as a whole.

Automatic Elevators

The most dramatic example of job loss through automation in the service occupations is that of the elevator operator.

In 1940, the U.S. Census Bureau found 76,860 persons employed as elevator operators in the United States. Ten years later, in 1950, the Census Bureau data showed that the number of elevator operators had increased by about 16 percent, rising to 89,185. Ten years after that, however, the number of elevator operators had dropped by about 19 percent to 71,882. Thus, there were approximately 5,000 fewer elevator operators in the United States in 1960 than in 1940.

The job loss shown so graphically by these statistics was due entirely to the improvement and widespread use of automatic elevators in the post-World War II era. While automatic elevators were found in many apartment houses before 1940, they were relatively rare in office buildings, hotels and other large structures where efficient vertical transportation was an hourly necessity.

Construction of high-rise buildings continued at an accelerated pace after World War II, and the need for elevators accelerated greatly. It has been estimated that in 1946 and 1947 most of the elevators installed had to be operated manually. In 1950 *Architectural Forum* estimated that only 12 percent of the newly installed elevators were automatic. However, that figure climbed to almost 60 percent in 1952 and reached 80 percent in 1953. Since 1958 practically all elevators installed in new apartment houses, office buildings, hotels, and similar structures have been automatic.

At the same time, many of the office buildings and some of the hotels which were constructed in prewar years have replaced their manual elevators with automatic elevators.

In some cases where automatics replaced manual elevators, attendants were kept to insure the safety or convenience of passengers, but in most cases the jobs were eliminated. In new construction only a few of the structures have used operators on the cars.

The occupation of elevator operator is gradually becoming obsolete. The 1970 census will undoubtedly show a more dramatic drop in the number of elevator operators than was recorded in the 1940-60 period.

How Automation Affects Jobs

The case, it seems to us, is typical of what happens when automation affects the service industries. Often jobs are not lost immediately. Through effective action by the labor union, for example, men may be retained on their jobs despite automation. However, in such cases the jobs are usually not filled after the present job holders depart; thus they are lost through attrition, or what has been called "silent firings." Perhaps the more important long-run effect is that no new jobs are created through automation.

It could perhaps be argued that the processes of constructing the automatic elevator and possibly the work required to maintain it do add some small increment of work beyond that required for the construction and maintenance of the old manual elevator. It could perhaps also be argued that the greater profits of the building owner who installs an automatic may result in greater spending on his part which could add some small increment to the total amount of work being done by the entire economy. However, it could hardly be argued that these two small increments of work could in any way replace the amount of work that is contributed to the economy by the elevator operator under the manual system.

The incidence of job loss through automation is rarely illustrated as dramatically as in the case of the elevator operator. It is more usual in the service industries for job loss to be more gradual and to depend upon the construction of new buildings rather than upon the alteration of old ones.

The Hotel Industry

In the case of hotels, for example, not only has there been a clear loss of jobs through the introduction of automatic elevators but also through the use of floor polishing machines and other equipment used to maintain the hotel. These losses have been rather small. It may, however, be anticipated—and the motels have set the example—that job loss in the hotel industry will be much greater in the future as new structures replace those now in use. This is evident from some recent construction and is also being predicted by hotel industry authorities.

For example, the Cornell University School of Hotel Administration sponsored a report (completed in 1961 by Fair, Isaacs, and Company, Inc.) on automation for hotels. The report concluded by mentioning the possibility in the future of ". . . a self-service hotel in which a guest operates an electronic room rack for himself, registers by use of a credit card, prepares his breakfast in his room using a self-service meal dispenser and high speed cooker, and checks out of the hotel, again using his credit card, without ever having come in contact with any of the personnel of the hotel."

Some of the Hilton hotels built in recent years in New York, Toronto, and San Francisco underscore the possibility of a completely automated hotel. The San Francisco Hilton features drive-in self-service parking, baggage handling, and registration (even to checkout and bill payment).

Hospitals

What is true in hotels is also true in hospitals. There have been some moves toward automation in hospitals—in the introduction of computers for record handling, in automatic monitoring systems using television, in devices for handling foods and records, and in cleaning operations. In general, however, it will be in the hospitals of the future that job loss will be most pronounced as these various devices which have been introduced in recent years and other newer devices are put together to produce a hospital which is largely automated.

In a recent issue of *Hospitals*, Dr. John R. McGibony, chief of intramural research, division of hospital and medical facilities of the U.S. Public Health Service, speculates on what the hospital of the future will contain. He sees future facilities with complex medical centers, regional, community, and satellite units, and day and night hospitals. Miniaturization will produce automated bedside techniques for instant diagnosis, he believes, and instant consultation will be achieved through microcircuit television.

Dr. McGibony foresees present kitchens being replaced by microwave cooking-within-floor vending machines, dishes being edible or disposable, and garbage and solid wastes disposed of through disintegration. Dust and dirt will be removed by electronic maintenance and laundries may not be needed because linen will be replaced by disposable sheets.

Hospitals are the fifth largest industry in the United States and the effect of automation on this service industry in the future will have a considerable effect on the total number of employees in the service industries.

Gas Utilities

Another industry our union has been connected with is the gas utility industry. This industry gives us an example of the effect of automation upon public utilities and other public service industries. Data released by the American Gas Association indicate that the number of employees in the gas industry increased slightly year by year in the postwar period until 1960, when there were 206,400. By 1964 the number had declined to 204,800.

Since 1950 productivity of the industry has been increasing. In 1950 the number of customers served per employee was 136.1; by 1960 this number had risen to 160.1; and it stands at 178.0 for the year 1964. Thus in this 15-year period there has been an increase of about 31 percent in the number of customers served per employee.

The total of gas sales per employee has also risen. It was $3,100 in 1950, $4,600 in 1960, and $5,000 in 1965. This represents a much larger percentage increase for the 15 years—about 61 percent—and only a small portion of this increase can be attributed to the change in the value of the dollar.

In its most recent statement the American Gas Association has attributed the increased productivity and the decline of the number of employees to automation in both the field and the plant, to more efficient use of facilities, and to the increased use of natural gas. However, in reports sent out in 1962 and 1963 the changes were attributed to automation only. Whatever the circumstances it is clear that automation has caused job loss in the gas utility industry.

Bowling Alleys

One industry served by our union which has boomed greatly in the postwar period is the bowling alley industry. The 1948 Census of Business indicated that there were 4,505 bowling alley establishments in the United States employing 66,777 people. Fifteen years later, in 1963, the number of bowling alleys had almost doubled to 8,858 while the number of bowling alley employees rose only to 88,073. Thus in 1948 there were almost 15 employees per bowling alley, while in 1963 there were only 10. If the proportion of employees to bowling alleys had remained the same as it had been in 1948, there would have been about 43,000 more employees in bowling alleys in 1963. While it is undoubtedly true that the number of jobs probably would not have increased in direct proportion to the number of alleys as larger alleys were built, it is also undoubtedly true that a very high proportion of the potential job loss was due to the installation of automatic pin setters in the new bowling establishments.

The extent of automation in the bowling industry can be seen from the following statistics: In 1955 there were about 60,000 alley beds in U.S. bowling alleys, with only about 11,000 of them operated by automatic pin setting machines. Ten years later in 1964, there were almost 3 times as many alley beds—172,000; but of these, 160,000 were equipped with machines. Therefore, the number of bowling alley beds serviced by live tenders declined from approximately 49,000 in 1955 to 10,000 in 1964. Thus even in a relatively booming industry the effects of automation in causing, job loss are visible, even where the total number of jobs has increased substantially.

Other Recreation Industries

.It is anticipated that with the growth of leisure time the American citizen will spend more time in recreation; some of this will undoubtedly be commercial recreation. Bowling alleys offer the most dramatic example of the effect of automation upon jobs in commercial recreation. But it should be noted that automation is taking place and will continue to take place in many other areas. The motion picture theaters offer examples of people being replaced through the introduction of automatic vending machines for soft drinks, candies, and even sandwiches, and through simplification of structure which allows the ticket seller also to permit customers to enter into the theater without having to pass a ticket taker.

In the race tracks, computers are now being used to do calculations which were formerly done by humans; and machines have been invented, although not yet perfected, which will permit the customer to both place bets and collect on them without the presence of mutuel clerks.

Importance of the Service Industries

It has been suggested that the basic nature of our economy is changing since the majority of the people in the labor force are now engaged in industries and occupations which are devoted to rendering a service rather than to producing a commodity. Wherever we look in this service area, whether it be in medical services, the traditional service industries, the recreational industries, or even State or local government, we see everywhere the introduction of automatic devices both simple and complex which tend to displace personnel in the long run if they do not do it immediately. The full effect of the introduction of these devices cannot be evident immediately since for the most part they require capital investment which delays the introduction of the device. Consequently, in some areas, such as hotels and hospitals, the full effect of automation will not be evident until many of the present buildings have been replaced by newer structures in which automation has been introduced as an integral part. However, while the effect of automation on job loss may thus be delayed for one or more decades, it should not be taken as a guarantee that this will, in fact, be the case, since the introduction of competing structures or the inroads of competing industries may also enter the picture to contribute to job loss. This is the kind of situation that exists where old hotels must compete with motels, which employ fewer personnel per customer, through the elimination of services which hotels commonly render.

It is true that in the entire service industry there is and has been job loss through automation and the continuation and accentuation of job loss can be expected in the future. That this will have an influence in reducing prices to customers and clients is to be doubted since the cost of services tend to rise under any circumstances.

There is unemployment throughout the service industries today—greater in some areas and smaller in others, but present nonetheless. The continual introduction of automation in the presence of unemployment constitutes, we believe, a threat to the future prosperity of a country where the service industries now play such an important role in the economy. It is also a threat to millions of persons now employed in the service industries and to others who will necessarily have to seek employment there in the future.

This threat to people takes on added importance in the service industries since many service workers are relatively mature; if they lose their jobs they find reemployment more difficult to secure because of the continuing prejudice against hiring older workers. Sometimes, because of their age, retraining is especially difficult, even where retraining programs are available.

Accordingly, it is the view of the Building Service Employees' International Union that the Federal, State, and local governments must all do whatever is possible to combat unemployment and to educate and retrain working men and women so that the most deleterious effects of this development will be minimized. Moreover, it is our view that no significant progress will be made in combating the harmful effects of automation until the standard workweek is reduced to 35 or fewer hours. The Federal and State governments can play an important role in the reduction of the workweek by amending the Fair Labor Standards Act and similar legislation to provide for a 35-hour week.

Our many years of experience with automation have convinced us that whatever its beneficial effects, it does have harmful effects on individuals and their families. We also believe that automation can threaten our entire economic system.

STATEMENT

Prepared for the Commission
by the
Burroughs Corporation
Detroit, Michigan

Statement by the Burroughs Corporation

As we continue to add length and strength to an unprecedented period of economic growth, the writer believes we are in a good position to look realistically at the total subject of automation. There is abundant evidence that a growing maturity is developing in our country regarding technological progress. More positive voices are now being raised to question the negative assumption that automation and related technology will soon force us into becoming a nation of "kept citizens."

We cannot minimize the fact that even in this period of general prosperity we have 96 percent of our labor force at work instead of 100 percent. We can ill afford to be complacent about this. But it is certainly a better average than the 93 percent employment figure of 1958, and the lesser percent has been attained with a much larger labor force. This substantial improvement has taken place in a period when automation was supposed to have wiped out the jobs of millions of citizens.

The real danger facing our economy today is not automation. Rather, it is the possibility that we might fail to take complete advantage of every opportunity for technological progress which is economically feasible.

In the United States approximately 800,000 scientists and engineers are working to advance our technological position on all fronts. This does not consider the many thousands of technicians and support personnel also involved in these efforts. We cannot afford to reject, out of hand, the accomplishments of these skilled people. Nor can we act as though the $100 billion spent since 1955 on research and development, currently at an annual rate of $20 billion, has been a waste of money.

To do this would be equivalent to saying, "We've progressed as far as we want to go. We're afraid to go down the road any farther, because what lies around the bend might startle us too severely, challenge us too boldly, and threaten the cocoon of security which we've made our primary goal." The writer doesn't believe for a minute that the American people intend to accept such a philosophy.

There are those who say that automation is so completely different from any kind of past technological progress that it will force us into a complete revolution in terms of our society and economy. Others say that automation is really nothing different from any of the past major technological advances. As is usual in debates of this kind, there is some truth on both sides and probably the real truth lies somewhere in between.

To the extent that automation as we know it today is an extension of man's power and dominion over the world around him, it is nothing totally or radically new. It shares this same characteristic with the earliest and most primitive tools of man. Obviously, modern developments in electronics have helped us move quickly into more sophisticated kinds of automation than was possible 20 years ago, and to that extent automation is "new." Some say automation is dangerous because it extends the power of the central nervous system rather than mere muscle power. We could argue about that and point out that the first adding machine built in 1886 was an extension of man's mental powers—or for that matter, we could go back to the abacus.

Instead of debating the precise definition of automation—whether it is new or old—we should take a positive approach. We should consider the creative power which automation puts at our disposal as a means to provide a more fruitful and abundant life for all of our people. And we ought to be moving toward a better education for all of our citizens so that they can reap these benefits.

Before the climate necessary to do these things effectively can be created, we must dispel some of the popular fictions which surround the subject of automation. Let's examine a few of them.

Fiction number one: Automation is destroying anywhere from 2,000 to 40,000 jobs per week in this country. Which number you choose depends on how pessimistic you want to be.

The fact is that no reliable evidence exists for the Nation as a whole concerning the net number of jobs being eliminated by automation. There is little likelihood of our getting such information in the near future because jobs are seldom eliminated or created because of any one factor.

Job displacement or creation can be and often is the result of mergers and consolidations, changes in plant locations, or shifts in product demand. This last point—changing product demand—is one of the most characteristic features of our economy. Look, for example, at the changing demand for fuel over the last two decades. Production of anthracite coal has declined from 56 million tons in 1951 to 17 million tons in 1961. During the same period, production of natural gas doubled and there was a substantial increase in production of crude petroleum. The same can be said for electric power capacity. Automation in the coal industry was certainly not responsible for the change in consumer demand.

Not only do these widely circulated fictions concerning job displacement fail to take into account the whole network of factors affecting jobs, they also create an unwarranted climate of fear. In many cases this fear of job loss due to automation, rather than of automation itself, has generated bitter labor-management disputes. The harmful economic effects of such disputes can often be more damaging to job security than the automation feared by labor.

An example of how automation creates jobs by providing better products and services at lower prices has occurred in the communications industry. In 1924, AT&T's Bell System employed 160,000 operators for 11 million phones; today there are 175,000 operators for 71 million phones, and overall, the Bell System employs over twice as many workers—some 760,000—as it did in 1924. While our total population grew by 70 percent, employment in this highly automated industry grew by over 150 percent.

A second fiction worth noting is the common belief that automation is a single, once-and-for-all kind of thing. But when we discover that literally hundreds of definitions are used to describe automation, we realize that it is not a single entity. Automation might be the application of a computer to an inventory control problem. It might be the use of very complex machine tools which perform dozens of separate operations automatically. It might be a multimillion dollar process control system which permits economical production of synthetic fiber. It is not one technique or one piece of gear. Automation will never be "here" in the sense that no further progress in technology of production, control, or computation is possible.

A great deal has been written implying that many industrial plants throughout the country are now great, empty caverns. Empty, that is, of human beings—filled only with the whirring and buzzing of automatic machinery, controlled electronically, monitored by a few white-coated scientists. The truth is that virtually no major industrial complexes in this country have been completely automated. Even though, in a few instances, such automation may be technologically possible, it is not economically feasible. In the final analysis, it will be the economics of each particular situation that will determine how far and how fast automation will proceed.

Job creation has been greatest among those larger companies—the top 500 industrial corporations in the country—who certainly can afford to use and develop automation equipment to the maximum extent. Between the years 1956 and 1963 their total employment increased 11 percent.

Those who worry about progress in automation coming too quickly should remember that there is a point of diminishing return in automating any given activity. In many basic industries in this country, significant strides have been made to automate some productive activities. However, each new step in that direction becomes increasingly difficult and a great deal more expensive. So if automation has proceeded more slowly than predicted, it has done so because the dynamic economy in which we live, with its variety of interaction and interplay of forces, has dictated that it move slowly.

The urgent reason for automating any given activity in business or industry goes beyond any desire to reduce labor overhead. The competitive forces at work both at home and abroad demand the continuous creation of new and better products and services—at prices people can afford to pay. In many instances computers and other automation devices are not performing tasks which had previously been done by men; they are performing tasks which hadn't been done at all. The extra checks in a system of quality control or the up-to-the-minute reports on inventory status facilitated by computers are activities which simply could not have been handled economically in the past.

The alternative to automation and other forms of scientific and technological progress is a downgrading of our industry, our economy, and our society in general. It would be planned obsolescence on a grand and tragic scale.

If we shrink from the challenge of automation, it will only be a matter of time before our position of leadership in world trade is whittled away. Other progressive nations are moving ahead with automation as quickly as their economies permit. We cannot strengthen or even hold our position in existing world markets, let alone penetrate the markets created by the developing nations, unless we commit ourselves to the productive power which automation and related technology make possible.

In the face of our growing desire to provide the fullest opportunity for all citizens, and in the light of mounting strong competition in world markets, it is time that we adopt a positive national policy on the subject of automation. Some steps have been taken in this direction. But we must do more, and the following actions are suggested:

1. Leaders of business, labor, and government should be courageous in making known to our Nation their unqualified support of productive technological change and automation. There should be nothing hidden or evasive about our pursuit of this goal.

2. We should continue to seek prudent tax revisions which encourage industry to spend for modernization of plants and equipment. We should press for realistic depreciation guidelines which recognize the increasing speed that equipment will become obsolete.

3. Instead of making automation the scapegoat of our unemployment problems, we should seek, through a large-scale and unified research effort, the real causes of the various types of unemployment.

4. We should stop talking about changes in educational procedures and start doing something about it. Fifty-one percent of our adult population do not even possess a high school education. And many who have a solid educational background have not yet realized the necessity of continually updating that education. Educational techniques and policies are needed which shape human resources to fill the needs of our times.

5. We need to develop a policy of closer cooperation among business, labor, educational, and governmental leadership to make the most of the opportunities of education. Just as the benefits of automation will accrue to all, so the responsibility for dealing with its problems must be shared by all.

6. Today the tools of automation, properly applied, could furnish the capacity to match job seekers with job opportunities on a national scale, and this should be our objective. The cost in dollars and human dignity to train and assist a man and his family—if they wished—to move to a productive job in another location would be less than to keep him living at a subsistence level where no job is available.

It should be borne in mind that the social problems which many people attribute to automation will be quickly compounded if we do not maintain an acceptable productivity and competitive posture. There is no way that we can avoid all social problems. The question is whether we minimize these problems by maintaining the maximum competitive effectiveness in the world market, or suffer the even greater social negatives which would accrue from competitive failure.

A national policy which endorses and promotes increased productivity and utilization of the more efficient tools and methods stemming from technological progress is absolutely essential.

There is no acceptable alternative because failure to achieve the necessary success in productivity could, over a period of time, relegate the United States to the position of a second-class economic power.

STATEMENT

Prepared for the Commission
by
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Statement by Clyde E. Dankert, Dartmouth College

Technological Change—Past and Present

It may well be that history proves nothing, but it can at least suggest much. In view of this fact a useful purpose might be served if we consider the current problem of technological change against the background of opinions and developments of the past. For 10 years now we have been keenly interested in, and legitimately concerned about, the impact of technological progress, particularly as it has been manifesting itself in the form of automation. But this is not the first time that such an interest and such a concern have appeared in this country—and in other industrialized nations. Nor is it the first time, one might add, that governmental and other agencies have probed into the problem. What, then, can history suggest to us as we analyze the issue in its present-day form?[1]

Section 1.

The establishment of the National Commission on Technology, Automation, and Economic Progress is clear evidence of the fact that we in the United States are concerned about the present and future effects of technological progress and that we are not satisfied with our current knowledge about these effects. In earlier years a similar situation existed in Great Britain (just as it exists to some extent today), where the industrial revolution had its start and where the impact of technological change was first seriously felt. The same situation was also found later on in this country.

Well over a century ago an English writer, William Ellis, stated: "There is perhaps no question within the whole range of the science of political economy which has been left in a more vague and unsatisfactory state than that of the consequences which flow from the employment of Machinery."[2] While immense progress has been made in both theoretical and applied economics since 1826, there is still much to be learned, not only by economists but by sociologists, psychologists, and others, concerning "the consequences which flow from the employment of Machinery." The extensive mandate given to the Commission certainly suggests that this is the case.

That the next 15 years after Mr. Ellis made his observation did not witness much advancement in the analysis of the mechanization problem is indicated by a statement made in 1844 by another English writer, Travers Twiss:

> There are few questions in the present day which have given rise to so much difference of opinion, as the probable effects which successive improvements in machinery are calculated to produce in the condition of the labourer. Whilst some contend that inventions to save labour are the greatest scourge of modern society, others maintain that they are amongst the chief blessings which civilization has brought with it in its train.[3]

During the course of the 19th century the problem of The Machine received attention in this country, as it had somewhat earlier in England, and here too opinion was divided. Such economists as Daniel Raymond, Arthur L. Perry, and Simon Newcomb discussed the issue, and other writers also took up the question. But for the most part the discussions were brief and general in nature.

Near the end of the century the Federal Government began to show a keen interest in the question of industrial mechanization and authorized the Commissioner of Labor, Carroll D. Wright, to make a study of the matter. The results of the study were presented in the 13th *Annual Report of the Commissioner* (1898), under the simple but suggestive title "Hand and Machine Labor." Shortly thereafter the extensive *Report of the Industrial Commission* appeared, and two volumes of the report (VII and XIV, published in 1901) contain information on technological change. Though the material presented in these reports is rather meager compared with the studies in the area made in recent years by the Office of Manpower,

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[1] In writing this paper the author has made some use of materials from his following earlier articles: "Automation and Unemployment," in *Studies in Unemployment*, prepared for the Special Comm. on Unemployment Problems, U.S. Senate, 86th Cong., pp. 225-250; "Technological Change and Unemployment," *Labor Law Journal*, June 1959, pp. 393-404; and "Labor Immobility and Technological Unemployment," *Social Forces*, Mar. 1941, pp. 426-434.

[2] *The Westminster Review*, Jan. 1826, p. 101. The controversy over the effects of machinery had been going on for quite some time before Ellis wrote his article. A useful treatment of earlier discussions will be found in Arthur Young's *Political Essays Concerning the Present State of the British Empire*, London: W. Strahan and T. Cadell, 1772, pp. 209-219. "It appears clearly to me," said Young, "that the writers *for* machines have greatly the advantage of the argument." *Ibid.*, p. 215.

[3] Travers Twiss, *Two Lectures on Machinery*, Oxford, 1844, p. 5.

Automation, and Training of the Department of Labor, it is nevertheless of interest. Moreover, its presentation to the public represented governmental awareness of a problem that existed then and continues to exist now. But no set of policies for coping with the adverse effects of mechanization were adopted as a result of the investigations made at that time.

In the latter part of the 1920's and the early 1930's there was a sharp return of interest in this country in the question of technological change, especially in its relationship to employment and unemployment. People now began to discuss the issues of "technological unemployment." This was a new term, coined by Professor Sumner Slichter in 1928,[4] but the phenomenon to which it was applied had long existed—even before the industrial revolution "formally" started during the latter part of the 18th century. The widespread interest in technological unemployment during the early thirties promoted (after a long lapse) renewed governmental interest in the question of technological change and resulted in a number of governmental inquiries.

In 1931 there was published (in the hearings on unemployment insurance before a select Senate committee) a study with the title, "Report of the Committee on Technological Unemployment to the Secretary of Labor." Later in the 1930's and in the early 1940's came the wide-ranging and highly informative studies of the National Research Project of the Works Progress Administration. The latter studies added greatly to our knowledge of technological change. They brought together an immense amount of material from an extensive variety of sources. In the early 1940's the Temporary National Economic Committee in its "Investigation of Concentration of Economic Power," also probed into the topic of technological change and unemployment, and added to the literature on the subject. But with World War II upon us, and with industrial activity and employment rapidly expanding, the interests of the country were directed into other channels and the studies of these groups were largely forgotten.

During the latter part of the 1940's and the early years of the 1950's our attention was once again directed to the question of technological change. This time it was not ordinary technological change but "automation." The new term, which covered a partly old and partly new phenomenon, captured the public fancy, and the ability to use the word intelligently, and with some degree of frequency, became one of the marks of enlightened citizenship.

There was serious concern during the 1950's concerning the impact, particularly the employment impact, of automation. This concern, as everyone knows, is still with us, though the economic recovery of the last 2 or 3 years seems to have diminished it to some degree. Not only has the public at large been concerned with the question but so has the Federal Government. And this concern of the Government has (during the last 10 years) manifested itself in various forms, including the appointment of the Commission.

If history is any guide, the Commission will add to our knowledge of the facts concerning technological change and its effects on society in general and on the workers in particular. Though history is not too reassuring on the point, it is to be hoped that the material gathered by the Commission will lead to the adoption and continued promotion of sound policies, both public and private, for coping with the adverse effects of technological change. And at the same time it is to be hoped that the material will lead to the rejection of unwise policies—and over the years a considerable number of such policies have been suggested.

Section 2.

History can suggest to us—indeed it can in this case definitely show—that there have long been differences of opinion concerning the effects of technological change and also that various efforts have been made in the past to obtain more of the facts concerning such effects. But what else can history suggest?

A general point it suggests is that in approaching the problem of technological change we should strive for a balanced view. Because of the lack of adequate information on some of the important aspects of technological progress, it is easy to be either excessively pessimistic or excessively optimistic on the matter. An example or two will illustrate this point.

A few years ago one writer stated, in words of Malthusian gloom, that in the opinion of experts when automation "really gets under way labor displacement will proceed at a geometrical ratio instead of an arithmetical ratio as in the past."[5] But to another observer, automation is the "key with which we can leave this dim vault and walk out onto the upland pastures—the Elysian fields."[6]

Sentiments of a similar nature have been expressed in the past. Though (in light of the Keynesian "revolution") it may seem a bit risky to speak of J. B. Say, it is interesting to note a statement that Say made in a letter he wrote to his friend Thomas R. Malthus back in 1821.

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[4] The term first appeared in print in an article by Professor Slichter in *The New Republic*, Feb. 8, 1928, p. 317.

[5] *The Socialist Call*, Apr. 1955, p. 9.

[6] Quoted by Robert H. Macmillan in his book, *Automation*, Cambridge at the University Press, 1956, p. 60.

"We who scribble paper in search of truth," he observed, "must be on our guard: if our writings should go down to our grandchildren, the terror with which we contemplate improvements which they will have excelled, may probably appear to them somewhat laughable." And then Say adds, perhaps with undue optimism, "I have always found, practically, that new machines produce more alarm than injury." [7] That people a century and a half ago were worried about mechanization and in some cases exaggerated its harmful effects—just as they do today—is evident from these statements.

Shifting to the United States, and to a later decade, we find a writer at the end of the economically depressed 1870's stating that "everywhere we meet with the same state of facts. The laborsaving machine is entering every field, and its entrance is to the workman an irrestible command to go." Referring to the workers, this writer asks two questions that have a very up-to-date ring: "Where is the field in which the supply is not greater than the demand? Who can show any reasonable hope that this will be reversed?" [8] It is well to point out that these questions (which imply a belief in a permanent scarcity of jobs) were asked in an era that was without the automobile, the airplane, the radio, television, movies, refrigerators, and innumerable other items that are now enjoyed by American consumers.

Coming down to the present century, to the early 1930's, we find another writer declaring that "our machines and our science of management have made us so efficient that there is no longer enough work to go around." [9] This statement was made during the period when the previous great wave of interest in technological change was sweeping over the country. The term "automation" had not yet been invented, and there were not any Eniacs, Univacs, or Ermas. But there was "technocracy," and this phenomenon was accompanied by grave fears concerning the labor-displacing effects of mechanization.

It is of significance to note that the statement about there being "no longer enough work to go around" was also made at a time when our *real* GNP was roughly about one-third of what it is today, and when our employed civilian labor force was over 30 million smaller than it is today. (For 1932 the figure was 38,940,000, compared with well over 70 million today.) It might be added, incidentally, that even Henry Wallace's glowing prospect of jobs in the American economy was over 10 million below the current employed labor force.

If the preceding quotations suggest anything, they tell us that we should be cautious about making remarks that (because of automation and other technological changes) "the supply of labor is greater than the demand," that "there is no longer enough work to go around." Yet if these statements are not being made today, the general view they represent seems to be widely accepted. There appears to be a common belief that we have reached, or are closely approaching, some sort of expansion limit; that our "work pool" is full, or nearly full, and hence available jobs will become more and more scarce—justifying, interestingly enough, Marx's view about an increasingly large "industrial reserve army." If this view is not widely held it is difficult to explain the confidence that so many people have in the job-creating effectiveness of such policies as early retirements, longer vacations, more paid holidays, shorter hours, and limitations on outside earnings under our Social Security Act. These policies, of course, can be defended on other grounds, but one of the most popular justifications for them is the one that relates to more jobs—not merely more jobs temporarily but presumably permanently as well. But more on this point later.

Section 3.

Some of the opinions expressed in former years on the question of technological change and unemployment suggest the desirability of price flexibility as a means for reducing the unemployment impact of technological innovations. At least the view was commonly held by the older economists that the volume of unemployment resulting from mechanization would be reduced due to the fact that prices would fall as a consequence of the use of new machines. Indeed, one of the earliest economists to discuss this matter assumed that the result of the price drop would be *more* employment than before rather than less. "What is the Consequence of this Abridgement of Labour, both regarding the Price of the Goods, and the Number of Persons employed?" asked Josiah Tucker back in 1758. "The answer," said Tucker, "is very short and full, *viz.* That the Price of the Goods is thereby prodigiously lowered from what otherwise it must have been; and that a much greater Number of Hands are employed." [10] Mr. Tucker is here assuming a very large response (a very elastic demand, one would say today) by the consumers to the lower price.

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[7] *Letters to Mr. Malthus* (letter IV), London, printed for Sherwood, Neely, & Jones, 1821, pp. 70-71. Say's statement preceding the last sentence reads: "When machines are thus slowly introduced, all the inconvenience of such inventions are avoided. In short, I have always found . . ."

[8] *Atlantic Monthly*, Aug. 1879. pp. 137, 142.

[9] *Harper's*, Nov. 1932, "Personal and Otherwise" section.

[10] R. L. Schuyler, *Josiah Tucker, A Selection from His Economic and Political Writings*, New York: Columbia University Press, 1931, p. 241. Tucker pointed out (p. 242) that the increase in employment of "Hands" was not immediate, but "in the End." Tucker's remarks are from his *Instructions for Travellers*, published in 1758.

Other economists expressed similar views concerning price flexibility. Thus in the next century Nassau Senior said, a bit more cautiously: "The usual effect of an increase in the facility of producing a commodity is so to increase its consumption as to occasion the employment of more, not less, labour than before."[11] Again it is assumed that the demand for the commodity is highly elastic. And to cite one more economist, this time an American, we find Professor Arthur L. Perry stating that laborsaving appliances "always tend to cheapen the products which they help to create."[12] Underlying the belief that prices would decline, at least ultimately, was the assumption that competition prevailed.

There can be no doubt that the employment impact of a cost-reducing technological change is lessened if the price of the good involved falls as a consequence of the lower cost. (There may still be serious short-run displacement, however.) Can we assume today, as many of the older economists did, that mechanization will lead to lower prices?

Certainly there are numerous cases in which decreases in cost consequent upon the use of improved machinery are passed on to the consumer in the form of lower prices. But it would be rash for one to say that this always happens. And it would also seem rash to say that where prices are reduced they are always lowered to the extent that they "should be."

The issue involved here relates to the way the monetary gains resulting from technological innovations are distributed. There are three major groups of possible recipients: the owners (employers), the employees, and the consumers. Arguments can be advanced in behalf of each group, and as a practical and ethical proposition it is desirable that all three share. In the case of the employers it should probably be only temporarily, thus stimulating them to introduce, before their competitors, still further innovations. But to what extent should each of the groups share? That, indeed, is the question. Some years ago Senator Ralph Flanders proposed an equal division of the "newly baked pie."[13] Senator Flanders' plan would have the great merit of administrative simplicity, but it might be argued that it would often involve one of the two types of injustice that Aristotle many centuries ago had in mind: the equal treatment of unequals.

But more cannot be said in the present discussion on this complex issue. However, it is desirable to point out that in general not enough of the monetary gains of technological change have been going to the consumers, with the result that the volume of technological unemployment has been larger than it otherwise would be. Strong unions are in a position to siphon more than their fair share of these gains. Similarly, strong employers—possessing some degree of monopolistic control—are able to get an excessively generous piece of the enlarged pie, particularly in the absence of unions.

It is true, of course, that the higher wages and the higher profits accruing to the workers and the employers will ordinarily be put to use, thus creating, at least after a time, additional employment opportunities. But the point is that the new jobs may be hundreds if not thousands of miles away from the point at which the technological innovations were introduced and where the displaced workers are left stranded. Moreover, the new jobs are likely to be in industries different from those in which the technological changes were made.

It should be added that if prices are to be reduced the initiative can come only from the employer group, not from the workers or the consumers. If companies reaping especially large gains from technological innovations will not pass on some of these gains to the consumer, one cannot blame unions for exerting strong wage pressure so that they too can share in the extra gains.

It would be naive to suggest that the Commission should advocate the breaking up of monopolistic business and labor organizations, to the end that the volume of technological unemployment be reduced. But one can properly suggest that the Commission express its opinion on the desirability of having prices fall, at least to some degree, when cost-reducing improvements are introduced into industry. Taking a position on this point—verbally coming to the aid of the consumer, so often the "forgotten man" in such matters—will not do any harm. It may do a little good.

Section 4.

If we can benefit from knowing what many of the older economists said about price flexibility, we cannot benefit to quite the same degree from what they said about labor mobility, which is one of the most crucial aspects of the present problem concerning technological innovations. The fact is, there was considerable difference of opinion on the issue of mobility—of occupational mobility, that is.

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[11] N. Senior, *Political Economy*, 3d. ed., London and Glasgow: Richard Griffin & Co., 1854, p. 166.

[12] *Elements of Political Economy*, New York: Scribner, Armstrong, and Co., 1877, p. 229.

[13] *Automation and Recent Trends*, Hearings before the Subcomm. on Economic Stabilization of the Joint Economic Comm., 85th Cong., 1st Sess., pp. 20-21. In 1958 Walter Reuther proposed a plan for a tripartite sharing of productivity gains in the automobile industry.

John Davidson, author of a minor classic on the subject of wages, declared, "The early economists spoke lightly of trade mobility, as if there were no real hindrances, or if, in a word, workmen took up, or at any rate could take up, a new trade every week." [14] Davidson's statement seems a bit extreme, though one can find evidence to support it. J. R. M'Culloch, for example, "spoke lightly of trade mobility," and his remarks were made specifically in connection with technologically displaced workers. Referring to the alterations in employment patterns sometimes resulting from improved machinery, M'Culloch declared that "In the majority of businesses, this is not perhaps so great a hardship as might at first be supposed. [For businesses have] for the most part many things in common [and] an individual who has attained any considerable proficiency in one, has seldom much difficulty in employing himself in another." [15]

But there were other economists and writers who did not go along with M'Culloch's view. Charles Babbage (whose "Calculating Engine" represented an early attempt to construct a giant brain) pointed out that workers who are driven from their old jobs as a result of mechanization are not always fitted for new jobs that are open to them.[16] Professor Senior, writing in more general terms, declared, "The difficulty with which labor is transferred from one occupation to another is the principal evil of a high state of civilization." [17] J. B. Cairnes, Francis Walker, and John Davidson, to name three more economists, also pointed to the difficulties involved in changing occupations.

Whatever the degree of occupational mobility that existed in previous centuries, we know that today there are often very formidable obstacles in the way of an easy transference of workers from one job to another. Recognition of this fact is clearly given in the public and private policies we have adopted for reequipping displaced workers for new types of employment. To some degree it is also evidenced by our increased efforts in the field of vocational training and vocational guidance—efforts directed towards the aid of persons whose capabilities are still in "disposable form," to use Cairnes' expression.[18]

Efforts directed towards training, retraining, and vocational guidance have great merit and should be expanded. There is no need to amass additional factual information to prove the point. In a highly dynamic economy it is of the utmost importance that the labor force be made as occupationally flexible and adjustable as possible. If this is done, not only will the volume of technological unemployment be reduced but the size of the GNP increased. Such a flexibility and adjustability is important whether existing unemployment is predominantly structural or nonstructural in nature, though it is especially important in the former case.

Professor J. B. Clark in his 60-year-old discussion of technological unemployment suggestively pointed out that "Every device that 'saves labor' calls for a *rearrangement of labor* in the system of organized industry." [19] In our highly dynamic economy the process of labor rearrangement is constantly going on. If the rearrangement is to be achieved quickly and efficiently our manpower policies must be directed towards the task. Fortunately we are now moving in the right direction, but much remains to be achieved in the way of making the best use of our manpower resources. Though we do not need additional facts to justify further action in this area, we do need a lot of facts to enable us to move in the right (occupational) directions.

Another type of mobility that is involved in the problem of technological unemployment is geographical or spatial in nature. On this matter the early economists did not have much to say, but some of the later ones did give serious thought to the matter. Adam Smith long ago observed that man is "of all sorts of luggage the most difficult to be transported." [20] Despite the vast changes in the means of transportation since 1776, Smith's statement is still true, a fact that greatly increases the seriousness of labor displacement. More than a century later William Smart, another Scottish economist, declared that "physically, labour is not mobile; historically, it has never been mobile; and, ethically, it should not be mobile." [21] Whatever historical truth Smart's statement may possess, his view that labor is physically immobile cannot be accepted as an accurate description of conditions today, certainly not of conditions in the United States.

The question of geographical mobility was discussed at some length by both Francis Walker and John Davidson. A statement by the former is especially worthy of note. As to the degree of mobility required, Walker affirmed that it is not necessary "that the whole body of laborers should be organized like a Tartar tribe, packed and saddled ready for flight." [22]

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[14] *The Bargin Theory of Wages*, New York: J. P. Putnam's Sons, 1898, p. 182.

[15] *The Principles of Political Economy*, 4th ed., Edinburgh: Black, 1849, p. 210.

[16] C. Babbage, *On the Economy of Machinery and Manufactures*, London: Charles Knight, 1832, p. 229.

[17] Senior, *op. cit.*, p. 217.

[18] J. B. Cairnes, *Some Leading Principles of Political Economy*, New York: Harper & Bros., 1874, p. 64.

[19] *Essentials of Economic Theory*, New York: The Macmillan Co., 1907, p. 249. Some years earlier George Gunton also spoke of labor-saving machinery as bringing about a "rearrangement" of labor. See *Trusts and the Public*, New York: D. Appleton & Co., 1899, p. 163.

[20] *An Inquiry into the Nature and Causes of the Wealth of Nations*, Cannan ed., Modern Library, New York: Random House, Inc., 1937, p. 75.

[21] *Studies in Economics*, London: Macmillan and Co., 1895, p. 131. The last part of Smart's statement must be interpreted in the light of the explanatory remarks he makes.

[22] *The Wages Question*, New York: Henry Holt and Co., 1876, p. 180.

The degree of geographical labor mobility in this country is quite large. Indeed, it is often too large, leading to fruitless wanderings for unavailable jobs. Very often, however, it is not large enough. This is true, for example, when displaced workers are unable or reluctant to move to, new communities where jobs are available. Both excessive mobility and inadequate mobility are individually and socially wasteful and should be avoided.

The Commission will undoubtedly consider ways of improving labor mobility—or labor fluidity, as Sir William Beveridge described it in his outstanding work on unemployment. The goal we should strive for is what Beveridge accurately described as "the organized fluidity of labor."

If this is to be achieved on an adequate scale it will be necessary to increase the work of our public employment offices and to improve the degree of coordination between the individual offices in the system. Moreover, we should seriously consider the advisability of having the Federal Government pay, in whole or in part, transportation expenses of unemployed workers who are willing to shift to jobs in new locations, a policy that a number of nations follow.

Both occupationally and geographically there is need, therefore, for a higher degree of "organized fluidity" in our labor force. The attainment of this objective will represent a notable contribution to the handling of the problem of technological unemployment and yield other economic and social benefits.

Section 5.

The general attitude among the older economists concerning the employment impact of technological change was optimistic. (David Ricardo, with his famous chapter, "On Machinery," may be cited as a striking exception.) The common view was that in the long run the displaced workers would be absorbed into industry. But some recognition was given to the temporary dislocations caused by mechanization, and a number of economists pointed to the need for remedial action.

John Stuart Mill, for example, in referring to the victims of improvements in industrial methods, stated in 1848 that "there cannot be a more legitimate object of the legislator's care than the interests of those who are thus sacrificed to the gains of their fellow-citizens and of posterity." [23] Some years earlier, in 1832, Thomas Chalmers, in speaking of the "temporary evils" associated with the employment changes caused by mechanization, referred to the "strong claim" that these evils make on "the aid and tenderness of the benevolent, when families, in large masses, are, for a period, thrown out of employment." But then our theologian-economist goes on to add that what is still more "healthful," the evils "form a strong call on the manufacturing class of labourers more particularly, to cultivate those providential habits by which, in virtue of their accumulations, they might be enabled to weather the seasons of suspense and change, to which every people of mechanic and highly artificial industry are so peculiarly exposed." [24] Save up for a rainy day, is Chalmer's suggestion—within limits not bad advice. To cite one more example, we find Cairnes a few decades later stating that changes in industrial methods and systems almost always involve "more or less temporary inconvenience, and sometimes even . . . considerable suffering" for those who have lost their jobs. And "this is good reason," Cairnes adds, "for society doing all in its power to alleviate and repair these inevitable but transitory evils." [25]

During the 19th century, and even earlier, there was recognition among economists of the adverse temporary effects of technological change, and some economists pointed to the need for corrective or ameliorative action. It is interesting to note a number of the policy suggestions that received attention from economists and others during this period.

Implied in some of the earlier statements about mechanization is a feeling that new machines should be introduced gradually rather than rapidly and spasmodically. As far back as 1767 Sir James Steuart stated, "The Introduction of machines can, I think, in no way prove hurtful by making people idle, than by the suddenness of it . . . ." [26] This statement was made almost 10 years before the publication of Adam Smith's great classic, *The Wealth of Nations*, which rather strangely neglects the problem of technological unemployment. Steuart's statement was also made in the early stages of the industrial revolution.

The general view expressed by Steuart was more vividly and quaintly stated by a later writer, Perronet Thompson, in these words: "Machinery then, like the rain of heaven, is a present blessing to all concerned, provided it comes down by drops, and not by tons together."[27]

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[23] *Principles of Political Economy*, Ashley ed., London: Longmans, Green & Co., 1926, p. 99.

[24] *On Political Economy*, New York: Daniel Appleton, 1832, p. 339.

[25] Cairnes, *op. cit.*, p. 267.

[26] *An Inquiry into the Principles of Political Economy*, vol. 1, London, printed for A. Millar and T. Cadell, 1767, p. 120.

[27] *The Westminster Review*, Jan. 1831, p. 194.

Karl Marx introduced a very discordant note when he affirmed, "When machinery invades a field of production by slow degrees, it produces chronic poverty among the workers that have to compete with the machines. When the transition is a rapid one, the effect of machinery is massive and acute."[28] Most of the older economists would not have agreed with the first part of Marx's statement; and today, in an industrial and social environment very different from that of the mid-19th century, few would endorse it. This does not mean, however, that when machinery is introduced gradually it never produces any misery, either temporary or permanent.

That the gradual introduction of machinery can lessen the amount of labor displacement is definitely the case. Our experience with the changeover to the dial telephone is an outstanding case in point. The difficulties in the way of adopting such a policy are formidable, however, particularly in industries that are highly competitive. But the policy is much more practical than the proposal made in this country in the 1930's to the effect that there should be an "inventors' holiday." The policy of gradually introducing technological innovations decreases the amount of catching-up that is necessary, and it should be seriously considered by employers. The possible economic loss associated with such a policy might be overbalanced by gains of a different sort, both economic and noneconomic. Under any circumstances, the gradual introduction of technological innovations need not, and should not, mean any decrease in the long-run rate of technological progress.

Among a number of very modest suggestions made by Charles Babbage is the proposal of "a diversity of employments among the members of one family." Such an arrangement, Babbage said, "will tend, in some measure, to mitigate the privations which arise from fluctuation in the value of labour."[29] This implies, of course, the existence of more than one breadwinner in the family. Such a policy of diversification is infinitely more difficult in the labor field than it is in the investment field where it is very easy to use a number of baskets. At best the suggestion strikes us today as a rather hopeless one.

Another old proposal relates to the levying of a tax on machinery. Early in the last century a tax of this character was suggested in England. Its purpose was to even up the competition between man and machines: man was compelled to pay taxes on the things he consumed but the same rule did not apply to machines.[30] The tax proposal has also been made in more recent years. In fact in 1939 a bill was introduced both in the House of Representatives (House Joint Resolution No. 65) and in the Senate (Senate Joint Resolution No. 3), whose purpose was to have the Secretary of the Treasury make an investigation into the question. Apparently no such investigation was made. Congressman John J. Cochrane and Senator Bennett C. Clark sponsored the bills.

The proposal for taxing machines, attractive though it may appear at first glance, would be administratively difficult if not impossible, and in addition it would probably be economically unwise.

J. B. Say, whose rather optimistic statements concerning technological unemployment we have already noted, suggested the use of public works as a means for aiding temporarily unemployed workers—a policy we are by no means unfamiliar with—and he also suggested the geographical shifting of workers. In a footnote statement Say declared that

> a benevolent administration can make provision for the employment of supplanted or inactive labor in the construction of works of public utility at the public expense, as of canals, roads, churches, or the like; in extended colonization; in the transference of population from one spot to another. Employment is the more readily found for the hands thrown out of work by machinery because they are commonly inured to labor.[31]

Providing care is exercised in the planning and administration of the policy, the "construction of works of public utility" still has much to commend it as a temporary aid to displaced and other types of unemployed workers. So has the policy of shifting workers to new job locations.

Section 6.

The older economists do not appear to have seriously considered the policy of reducing hours as a means for coping with technological unemployment. But such a proposal is by no means new, certainly not in the United States. The best known statement of the suggestion is that made by Samuel Gompers back in 1887, in his annual report to the AFL. "The displacement of labor by machinery in the past few years," said Mr. Gompers, "has exceeded that of any like period in our history." After referring to various illustrations of mechanization, the AFL leader went on to say, "The answer to all opponents to the reduction of the hours of labor could well be given in these words: 'That so long as there is one man who seeks employment and cannot obtain it, the hours of labor are too long.' "[32]

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[28] *Capital*, vol. I, ed. by Ernest Rhys, Everyman's Library, London: J. M. Dent & Sons., Ltd., 1932, p. 461.

[29] Babbage, *op. cit.*, p. 230.

[30] See William Smart, *Second Thoughts of an Economist*, London: Macmillan and Co., 1916, p. 59 Early discussions of the tax proposal will be found in *The Quarterly Review*, Oct. 1828, p. 410, and May 1830, pp. 256, 261. See also Travers Twiss, *op. cit.* pp. 61-62.

[31] *A Treatise on Political Economy*, New American ed., Philadelphia: Lippincott, Grambo & Co., 1853, p. 87.

During the last 10 years the policy of reducing hours as a means for dealing with technological and other types of structural unemployment has been widely supported. Many have felt that automation has not only made a reduction in hours possible but necessary—necessary if we are to bring down the amount of unemployment to a reasonable level. It will not be possible in the present analysis to enter upon a detailed discussion of this proposal but a few observation can be made.

1. The unemployment argument for shorter hours is based essentially on a belief in a more or less fixed work-fund, a belief in the notion that there is just so much work to be done. If such a belief is correct, then, in view of the continuous increase in technological innovations and the rapid growth in the size of our labor force, it follows that hours will have to be reduced if all able and willing workers are to have jobs.

A knowledge of history should make us cautious on this matter. Have we, one should ask, reached a point of near satiation in our material wants? While Thoreau may have felt that "a man is rich in proportion to the number of things which he can let alone," the great mass of Americans do not share this view. There is a vast reservoir of latent and untapped wants in this country, not only in Appalachia but throughout the Nation. The satisfaction of these wants will be realized when those who possess them obtain more purchasing power.

This purchasing power is not likely to be obtained by enforced reductions in hours with take-home pay remaining the same; that is, real purchasing power, in contrast to money purchasing power, is not likely to be gained. The real purchasing power of an economy depends on its physical output; and it is difficult to see how shorter hours could lead either directly or indirectly to such a result. If it is argued that output will actually be greater with the shorter hours than it was before, then the basis of the unemployment argument for shorter hours (i.e., a fixed amount of work to be done) is destroyed.

It is possible, of course, for specific groups of workers to increase, or at least maintain, both their monetary purchasing power and their real purchasing power at the same time that they win shorter hours through their power in the labor market. But the fact that one group can achieve such a combination of objectives is no proof whatever that all groups together can win these objectives. On this matter, as on many others, one cannot jump from the "particular" to the "general" without committing a serious logical error.

Another point concerning the purchasing-power notion must be made. Under certain conditions it is possible that an increase in the volume of monetary purchasing power in an economy can act as a stimulant to business in general, thus leading to greater industrial output and to an expansion of real purchasing power in the Nation as a whole. But in the present situation, there is little reason for believing that efforts to force down the hours of work while maintaining wage rates would achieve such a goal. This is true whether the efforts are made by individual unions in their negotiations with employers or by the Government through amendments to the Fair Labor Standards Act.

(One could argue that a more equitable sharing of jobs—brought about, say, by double time for overtime—would be desirable even at the cost of some reduction in aggregate real income or purchasing power. This is a slant that is usually not emphasized by supporters of the shorter-hour policy. The limitations and dangers of such a policy make it unnecessary to discuss it further at this point. Crucial considerations in connection with the policy would be the point at which the heavy overtime rate started and the amount of production loss that should be permitted.)

If it is felt that the economy should be stimulated via the method of increased monetary purchasing power, it would be better to have the task done through governmental fiscal and monetary action. We have good evidence of the effectiveness (and possible dangers) of such action. We have little evidence of the general stimulating effects of reducing hours and maintaining wages.

2. A case can be made out for temporarily reducing hours but at the same hourly wages, which means a decrease in take-home pay. This policy involves sharing work and wages. Over brief periods the amount of work to be done in the economy is largely fixed, and hence when the total amount of such work is not adequate for full employment there is some merit in sharing it. This policy, as a matter of fact, is sometimes used, and its more extensive employment now would seem desirable. But at the same time more vigorous use should be made of policies designed to stimulate the economy.

3. It is not to be inferred from the preceding paragraphs that in no instances are per-

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[32] *Labor and the Employer* (comp. and ed. by Hayes Robbins), New York: E. P. Dutton & Co., 1920, pp. 81-83.

manent reductions in hours desirable at the present time. It may well be that for some workers the "work-leisure ratio," as one might call it, is not satisfactory; and that too much emphasis is placed on work (and wages) and too little on leisure. As the productivity of industry increases and real wages go up, increased leisure becomes more significant to many persons. This, indeed, has been a basic factor in the long-term trend towards shorter hours in the past, and it will continue to be a basic factor in the future. The more "goods" we have the more willing we ordinarily become to sacrifice a certain amount of additional goods for additional leisure.

Barring unforeseen emergencies, hours of work in the future should continue their downward trend. In terms of worker welfare it is desirable that this happen.[33] Before many years go by the 35-hour week, which some workers already have, will be widely in operation; and by the 1980's we should be making some progress toward the 30-hour week, a standard already achieved by Local 3 of the Electrical Workers in New York (a 25-hour week, indeed, but with 5 hours of guaranteed overtime at time-and-a-half). Hour standards which were at one time looked upon as utopian, such as the 6-hour day that Sir Thomas More established in his imaginary society, are within our grasp. The attainment of such standards can give us a certain amount of justifiable pride, at the same time however that they give us a considerable amount of worry. "The threat of leisure" (the title of a book written by President Cutten of Colgate back in the 1920's) is not an empty threat.

But returning to the more immediate situation concerning shorter hours, a few additional observations on the central question before us should be made.

(a) Hours should not be reduced too fast. In other words, we should not sacrifice production unduly (by lessening its rate of growth if not its actual amount) in the interest of more leisure. At a time when we are engaged in a "production battle" with the Soviet Union we must proceed carefully in cutting hours. And in light of our obligations and commitments to other nations the same conclusion holds. Certainly these nations are more likely to be helped and encouraged and impressed by increases in the volume of our industrial output than by increases in the amount of our leisure time.

(b) The achievement of shorter hours will not "solve" the unemployment problem. We can have as much unemployment with a regular 25-hour week as we can with a 40-hour week. The root causes of unemployment—whether seasonal, structural, cyclical, or "miscellaneous" —are not removed by a shortening of hours. The experience of the last century in this country, while it does not prove that this is the case, at least suggests that it is.

It is possible that temporarily more jobs may be provided by shortening hours, but this is by no means a certainty. It depends on such factors as the extent to which labor costs are increased (by the enforced maintenance of the same amount of take-home pay), the number of workers covered by the shorter-hour arrangement, and the steps employers take when confronted with enforced wage-rate increases.

(c) The current rate of growth in man-hour productivity would seem to justify for some workers, and on the basis of welfare considerations, modest reductions in hours at the present time. But this is on condition that the normal annual increases in wages are lowered somewhat. A drop in hours from 40 to 39 a week, with weekly pay remaining the same, means an increase in hourly wage rates of approximately 2.6 percent. If there was superimposed on this a normal wage increase of, say, 3.5 percent, our wage guidelines would indeed be shattered and serious economic consequences would likely follow.

A highly significant consideration is that today higher wages and shorter hours are usually alternative forms in which the fruits of increased productivity may be taken or consumed. We are faced with the constant problem of trying to strike a proper balance between the two forms.

The Commission will undoubtedly hear pleas for shorter hours as a means for coping with technological and other types of structural unemployment. It is the contention of the writer that such a policy would do little, if anything, to achieve its avowed goal. If I believed that there was some immutable law which decreed that the material wants of the American people were no longer expansible, then I would favor permanently shorter hours (but without the same take-home pay) as a desirable means for sharing the available work. But such a law does not exist. Nor is there any law that decrees that we are unable to satisfy—to devise means to fulfill—the immense volume of actual and potential wants that we possess.

The advocacy of a shorter workweek, of longer vacations, and of earlier retirements as means for spreading employment, understandable though it may be, will not lead us into any fruitful paths in our quest for solutions to the unemployment problem. Instead of directing our thinking to the implementation of such proposals we should be giving thought to other policies, particularly to policies which offer promise of increasing the growth rate of the economy and to improving the occupational and geographical mobility of its labor force.

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[33] For a more detailed discussion of the "welfare" aspect, see Dankert, "Shorter Hours—in Theory and Practice," *Industrial and Labor Relations Review*, Apr. 1962, especially pp. 312-316.

STATEMENT

Prepared for the Commission
by the
Edison Electric Institute
New York, New York

Statement by the Edison Electric Institute

Edison Electric Institute is the principal trade association for the investor-owned electric light and power companies, which provide electric utility service to about 80 percent of the American people. The balance of the industry is made up of various Federal, State, and local governmental operations and rural electric cooperatives financed by the Rural Electrification Administration in the U.S. Department of Agriculture. The chief differences between the investor-owned companies and Government-owned and/or financed operations are in the cost of money and tax liabilities of the investor-owned companies from which the Government operations are largely excused. Our comments will, in the main, concern the investor-owned segment of the industry.

Technological change has been continuous in the electric utility industry from its inception. Edison's Pearl Street generating station, with a total capacity of 720 kilowatts, began operation in 1882 with 59 customers. In the relatively short space of a little over 80 years, the industry has developed a generating capability of 222.4 million kilowatts serving over 64 million customers. Edison's power plant consisted of six 120-kilowatt generators. Now single units of 1 million kilowatts are in operation. As of April 1, 1965, 35 thermal units totaling 21.6 million kilowatts that were scheduled to go into operation within the next few years are in sizes of 500,000 kilowatts and larger. This constitutes 42.4 percent of the total presently scheduled thermal capacity.

Whereas the Pearl Street station required 10 pounds of coal to generate a kilowatt-hour, a present-day high temperature, high pressure steam turbine generator requires only 6/10 of a pound of coal to generate a kilowatt-hour.

Distribution of electric energy generated at Pearl Street was confined to a very limited area in New York City. Today there are over 400,000 miles of transmission lines comprising a network covering the entire United States. Higher and higher voltages have made it possible to strengthen and extend this network to the end that nearly all major power systems in the United States, providing some 97 percent of the Nation's electric energy requirements, are members of one of several major interconnected operating groups extending across the Nation. Power pools among companies have been formed which make possible the realization of the economies of scale regardless of the size of an individual company.

Improved design, tools, and methods for construction and operation of transmission and distribution systems have enabled companies to hold the line on costs in performing these functions, better the reliability of service, and improve the appearance of their overhead structures. Progress is being made in placing underground distribution lines and in further improvement in the aesthetics of utility installations.

Automation is nothing new to the electric utility industry; however, the electronic computer has broadened and accelerated its application. Coupled with the installation of larger and larger units, power plants can be manned by relatively fewer personnel. Indeed, some plants are fully automated to the end that they may be remotely controlled. Computers permit the scheduling of production so that the most economical plants are fully utilized. Power pool operation is facilitated by the use of computers, not only in the economical scheduling of plants in the pool, but also in equitably distributing the benefits of such operations to all the members of the pool.

Computers have also reduced the man-hours required in solving complicated engineering problems, and in the accounting phase of the business; and, among other things, they provide management with up-to-the-minute facts on which better decisions can be made.

When Edison's Pearl Street station began operating, lighting was the only load to be served. Today, there are at least 166 different electric appliances for use in the home, ranging from shoe polishers and toothbrushes to ranges, freezers, water heaters, and complete climate control. Over 2 million homes in the United States are now heated with electricity. It is predicted that by 1980 some 19 million homes will be heated with electricity.

Industry is now practically 100 percent electrified with direct drive electric motors having replaced the gang shaft and pulley belts. Higher intensity lighting and complete climate control have made industrial plants more pleasant and healthful places in which to work.

The development of the fractional horsepower motor and electronic control devices have made possible the automation of industrial processes.

The progress in technological change in the electric utility industry has by no means reached a plateau.

In 1964, expenditures for research and development by 148 electric power companies, 14 leading equipment manufacturers, and Edison Electric Institute amounted to $152.7 million. The Edison Electric Institute research program has been substantially expanded. Currently it is sponsoring or supporting 35 active projects with an overall cost of about $12.1 million. The Institute has recently signed an agreement to sponsor studies at General Electric Company's Pittsfield, Massachusetts, extra-high-voltage transmission research facilities. These studies will fill gaps in existing knowledge of extra-high-voltage transmission and will probe advanced areas of insulation, radio noise, corona, meteorology, and other matters related to EHV transmission.

Edison Electric Institute has also begun construction of a $1.5 million research facility at the University of Pennsylvania as part of the $2.2 million EEI research program on direct current, extra-high-voltage transmission.

In the field of atomic energy, 130 electric companies in cooperation with the Atomic Energy Commission and equipment manufacturers are participating in 1 or more of 28 projects aimed at making atomic energy a practical, economic source of electric power. Research is also being carried on in the more exotic methods of producing electric energy, such as nagnetohydrodynamics.

Technological change in the electric utility industry has been quite considerable, as can be seen. This progress in the art will continue for many years at an accelerating pace.

The effect of past progress is apparent from the performance of the industry. The overall result has been a constant holding down of the average cost per kilowatt-hour of electricity to the consumer, which, coupled with continuing increase in use stimulated by sales efforts, has made America the largest user of electric energy in the world, and among the highest in electric energy used per capita. It has been demonstrated by studies made of practically all countries that the increase in electric energy use per capita and income per capita go hand in hand. As income per capita increases, electric energy use per capita increases, which, in turn, causes income per capita to increase further.

It has been well established that although the United States is among the leaders in electric energy use per capita, we are still in the early phase of our growth. Our studies indicate that electric energy use per capita will about quadruple by the year 2000. If this growth continues to follow the pattern, we will not reach the leveling off point for another 2 centuries. This would be at a point of about 100,000 kilowatt-hours per capita.

To achieve this there must be a continuing emphasis on research and development, not only in the techniques of production, transmission, and distribution of electric energy but in the development of new applications. Heating of homes with electricity and year-round climate conditioning offer great possibilities. Another field of opportunity lies in transportation—both mass transportation and the private automobile.

What does this mean to our economic progress?

It means a higher and higher standard of living, more comfort, more laborsaving devices, and increased productivity.

As to administrative and legislative steps that should be taken that would aid us in achieving this progress, we believe that an end should be put to the so-called pluralistic characteristic of the industry. We believe the job can be done better in the private sector of our economy than it can be done in the public sector. The criteria used by Government agencies in justifying their entry into the electric power business are unrealistic and result in an inefficient allocation of the Nation's resources. We believe that in order to achieve maximum economic progress with the most equitable distribution of the fruits therefrom, steps should be taken immediately to remove the Government from proprietary enterprises. We believe, for example, when the Government builds a dam for flood control, navigation, or conservation, if electric power generation is feasible, the electric power generation should be left to the investor-owned companies, with their financing the generating equipment in the free market and buying falling water from the Government. The benefits then would redound to all our people rather than the few who now have preference in the purchase of electric energy generated at Government projects. As it now is, these projects are financed with tax monies on which only token interest is paid, and they make little or no contribution to the support of Government. They pay no Federal income taxes and, other than TVA and the Hoover Dam project, they make no contributions to State and local governments.

The Federal Government finances so-called rural electric cooperatives with loans through the Rural Electrification Administration at an interest rate of 2 percent—less than half of what it currently costs the Government to borrow money. These cooperatives pay no Federal income taxes. This program was put into effect during the depression of the 1930's, first as a relief measure, then as a continuing means of getting electric service to our farms more rapidly than could then be done by the companies. Ninety-eight percent of our farms are now electrified and most of the new customers being served by these cooperatives are nonfarm customers. The cooperatives are assuming a utility responsibility and competing vigorously with the investor-owned companies which must pay the full market cost of money and which pay their full measure of Federal, State, and local taxes.

Better than one-half of the funds now being loaned by the Rural Electrification Administration are for the construction of electric generating plants, even though energy can be purchased by the cooperatives from the investor-owned companies at less than it costs the cooperatives to generate it.

These Government programs require an unnecessary expenditure of Government funds; they result in an inefficient allocation of the Nation's resources; and they discriminate among the American people. We believe that it would be in the public interest and the interest of economic progress of the Nation that they either be discontinued or the discriminatory features be removed.

The investor-owned electric utility companies are not opposed to regulation by Government authority. We believe that sound regulation has furthered our ability to make the progress we have. We also believe there are areas where regulation by the Federal Government is necessary to supplement regulation by State authorities. However, recently there has been a growing tendency for the Federal Power Commission to encroach on matters of State jurisdiction. A recent decision of the U.S. Supreme Court interpreted the Federal Power Act as giving FPC the jurisdiction it has assumed, although it results in a duplication in the regulatory process. We believe such duplication is unnecessary and a hindrance to the progress of the industry. In light of the Supreme Court's decision, we believe the Federal Power Act should be amended so as to leave the States those matters which are of a local nature and over which they have ample authority to exercise jurisdiction, and to limit the Federal Power Commission's jurisdiction to those matters over which the States cannot exercise jurisdiction under the Commerce Clause.

STATEMENT

Prepared for the Commission
by
FMC Corporation
Canning Machinery Division
San Jose, California

Statement by FMC Corporation, Canning Machinery Division

Canning Machinery Division of FMC Corporation was one of the initial companies which formed the basis of FMC Corporation in 1928, then known as Anderson Barngrover Company. It developed the first continuous can cookers and food preparation machinery for the California canning industry. In developing these machines another portion of FMC Corporation was then known as the Sprague-Sells Company, which manufactured a line of automatic equipment for processing peas and corn for the Midwestern canning industry. We are proud to say that this division was pioneering in automation long before the term was coined. Canning Machinery Division has steadily, since 1928, spent large sums of money on research and development to improve the product lines mentioned and to develop new ones which have gone a long way to keep canned fruits and vegetables the bargain they are today in spite of canned food production costs, which have steadily risen during this period. Had not the continuing effort and development taken place canned food would certainly be in the luxury class today. To be sure there was some technological displacement of workers who were engaged in preparation of products, manually carrying out the cooking and sterilization process, but so far the economy has been able to absorb the displaced workers. Because this effort has benefitted so many people our social conscience remains inviolate.

It is our intention to continue our development of labor and cost saving devices for the food processing industry, which will cause more technological displacement at a rate we cannot forecast. However, automation is so commonplace in the food industry at this time we would not think the technological displacement would be a significant factor in the overall economy of the United States.

There has been much cannery displacement here in California in the last 5 years. For instance, we and our competitors have developed completely automatic peach-pitting machinery, which has displaced hundreds of women who used to hand feed these machines. Hundreds of these automatic machines are in operation in the peach canning industry.

We are currently in process of making obsolete our own older pear preparation machines, which were also hand-fed. Newer machines are fed from bins and peel and core pears at 400 per minute, replacing older hand-fed machines which operated at 50 per minute; thus seven women were immediately displaced as each of these machines went into operation. It is anticipated in the next few years that these machines will be operating at 600 pears per minute.

Within the next 10 years a similar kind of displacement of workers will occur in the apple production industry, where automation has not reached a very high level. When and if this occurs, we would estimate that approximately 3,000 or 4,000 seasonal workers would be displaced. However, these workers are not in general dependent on income from this type of work for a livelihood. Most of them are women, and some of them, of course, in the Midwest and East will present more of a burden to unemployment and relief rolls in the State where they work.

New methods are being developed for processing types of canned food which have not been previously subject to continuous production. New can processing machines are entering the market, each of which will displace 10 to 15 people engaged in cookroom labor. These new container processing machines will probably displace about 3,000 or 4,000 workers. It is possible within the next 10 years that major basic canned food plants will consolidate and automate to the extent that the petroleum and chemical industries have, through the use of higher speed, more automatic equipment and the use of digital and analog process control techniques.

We would estimate within the next 10 years that continuing automation requirements of our customers for additional cost reduction to maintain reasonable prices for their products will cause the displacement of approximately 10,000 to 15,000 people. As was mentioned, the primary effect of this displacement will be on the relief, welfare, and unemployment rolls of the communities where the displacement occurs.

The Canning Machinery Division also engages in the manufacture of harvesting equipment, and over the past 15 years has completely automated the picking of sweet corn for canning purposes. These machines were developed shortly after World War II when harvesting labor was not available and the principal harvesting was done by hand, using Bahaman, Jamaican, and Puerto Rican labor. Large numbers of displaced Puerto Rican labor wound up in New York City after the machines took over the harvest. The machines are capable of harvesting 24 hours a day and probably have displaced approximately 5,000 field hands.

A similar picture is emerging in California at the present time, and we and our competitors are developing harvesters to replace the braceros who are no longer permitted as harvest labor in the West to any reasonable degree.

In general, the class of labor that has been replaced by our development effort is in the semiskilled or unskilled class. These displacements will occur in California, the Pacific Northwest, Illinois, Pennsylvania, Michigan, New York, and New Jersey, for the most part.

You have asked for definition of areas of unmapped community and human needs as new applications of new technology might effectively be directed. To our way of thinking, the biggest social problem today is in water, hard and soft waste disposal, and pollution of air and water. In this area a whole new industry supported equally by Government and industry could emerge in the next 10 to 15 years. This industry could be of the size of the General Electric Company, for instance and would require more than a $100 million to develop.

STATEMENT

Prepared for the Commission
by the
General Electric Company
New York, New York

Statement by the General Electric Company

Automation: Its Impact on Employment and Unemployment

Automation is bitterly condemned as society's curse in some quarters; enthusiastically hailed as the key to solving all of society's ills in other quarters; and rarely defined or understood by either side.

Those who are concerned with public policy toward automotion are confronted with a proliferation of competing and sometimes conflicting demands as to what should be done. The main questions of concern and controversy swirl around automation's impact on employment and unemployment and what should be done about it. It is even seriously proposed that the impact of automation is so revolutionary that ". . . the traditional link between jobs and income is being broken . . ." and society must therefore "provide every individual and every family with an adequate income as a matter of right."[1]

The question of automation's impact on society deserves careful study and evaluation. Wise and humane public policy can only come from a realistic understanding of just what automation is and especially how it relates to employment and unemployment.

Definition of Automation

What is automation? As is often the case in widely discussed and controversial subjects, this word has taken on a variety of meanings and emotional overtones. The definitions of automation range from the very simple to the highly technical and sophisticated.

In popular understanding, automation has tended to emphasize the most recent aspects of technological change, which are describable but not necessarily distinguishable from earlier technological advances in any fundamental way. A backward look at technological change indicates that progress frequently comes in the form of new sources of power and degrees of self-regulation or automaticity, in addition to such other developments as better materials, designs, and methods in building machinery.

Man's sources of power have evolved through such stages as human strength, the use of animals, wind, waterfalls, and fire and steam from fuels such as wood, coal, oil, and gas. When man harnessed electric power, he opened up whole new capabilities. And now man looks to atomic fission and ultimately to thermonuclear fusion for additional sources of power. And modern electronics may be regarded as a growing body of highly advanced and specialized applications of the physics principles which gave us electricity.

A similar type of evolution has taken place in the self-regulatory or automatic devices used with machinery. Indeed, control mechanisms have generally appeared along with the types of power used to drive the equipment. In the same "automatic" way that the safety valve and fly wheel governor are used on steam driven equipment, the variety of electrical and electronic controls and switching devices are generally used with equipment run by electric power.

More technical definitions of automation tend to place the primary stress on new kinds of automatic processes which can be performed through the use of electronic circuitry. Thus, automation is sometimes described in terms of integrated arrays of complex electronic devices, including computers.

There are two disadvantages in describing automation largely in terms of the most recent forms of technological progress. First, it creates the mistaken impression that we are dealing with an entirely new phenomenon that has little or no connection with the earlier scientific and technological advances which made automation possible; in varying degrees, technological change is a blend of the old and the new. Second, the arbitrary divorce between the newer and the established production methods tends to prejudge the question of whether the modern advances will be as beneficial as past technological progress in increasing employment output and standards of living.

Whether you use such terms as servomechanism, closed loop, or feedback device, the familiar heating thermostat has been around the house for a long time. However defined—call it automation, and say feedback, or call it technological improvement and say thermostat —the important thing is that whatever it is called its purpose is to increase productivity—produce more and/or better goods and/or services with fewer productive resources.

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[1] Statement on "Triple Revolution: Cybernation, Weaponry, Human Rights," by an ad hoc committee of 32, first published in *Liberation*, Apr. 1964.

While not very much can be gained in arguments over the definition of automation, it is important to spell out its relationship to productivity. Automation and productivity are not identical in that automation represents only one method—albeit a highly effective method—of raising productivity. The output or production of goods that can be obtained from the use of input of human and nonhuman resources can be strongly affected by factors other than automation, especially in the short run. Even though no changes take place in the kinds of machinery and equipment being used, productivity may rise because of, for example, changes in the organization and methods of production and increases in human effort. Also, it is generally recognized that year-to-year changes in the volume of production may substantially affect the productivity gains from period to period. While recognizing the distinction just made, we place a high value on automation primarily because of its important contributions to productivity improvements.[2]

Automation, Employment, and Unemployment

On the other hand, automation has caused much apprehension, even alarm, over the question of how it relates to employment and unemployment. Two kinds of assertions are often made.

First, it is stated that automation will lead to a progressive *decline in job opportunities* relative to labor force growth. We are told that automation has been causing the disappearance of more than 2 million jobs per year. Further, it is said that automation not only takes people off jobs but prevents others from being hired because automation supposedly results in fewer job opportunities than there otherwise might be. One chilling expression that has been used is "silent firings." Finally, there is reasoning that automation cannot significantly create net new jobs in the running, building, and maintenance of machines because it would not make economic sense to automate if more workers were needed than before.

The second type of statement about automation deals with the ability or inability of the work force to make the necessary adaptations to move from jobs which are becoming obsolete to new jobs in the expanding occupations which may involve increasing amounts of skill, experience, education, and training. The concern here is that even if the number of new jobs equaled or exceeded the number of old and disappearing jobs, the displaced employees cannot be rapidly retrained and easily placed in new and better jobs. Instances of retraining program failures are cited. Another problem purportedly created by automation is that people who are disemployed in one part of the country will not be reemployed elsewhere because, for a variety of reasons, people are unwilling and/or unable to move to where jobs can be found.

Because of the serious personal and national problems which unemployment can represent, assertions and speculative judgments about the role of automation as a cause of unemployment merit the fullest and most careful analysis. Much of our ability to devise and follow constructive public policies affecting automation depends on a correct diagnosis of its effects.

Automation's Effect on Employment Levels

The relationships among automation, employment, and unemployment come into the clearest focus when we look at these relationships in two ways: partially and totally.

The partial view of the production process lets us see that one major purpose of automation or technological change is to reduce the amount of labor and/or other things required to turn out a specific amount of product of a given quality. Given a hypothetical situation where (1) the total amount to be produced remains the same, (2) product quality does not change, and (3) nothing else changes except that there is a technological improvement, the result is that less labor and/or other productive factors are needed to produce a given output. In this sense automation serves *to increase* productivity so that fewer man-hours of labor, etc., are required to produce a stated amount of product.

This partial view is an intentional oversimplification for the purpose of helping us separate out the effects of only one of the many forces (automation) at play in highly complex production situations. The conclusion is that, other things remaining the same, automation will reduce labor and/or other requisites of production.

But the real world is not that simple. Automation is only one of the many things which determine how much employment, labor displacement (going off one job but, very likely, obtaining another job), and unemployment occur. A more total view is necessary to understand the role of automation in firms, industries, our national economy, and the international arena.

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[2] Leon Greenberg, assistant commissioner of the Bureau of Labor Statistics, U.S. Department of Labor, has described the significance and sources of productivity gains as follows: "Gains in productivity provide the means for increasing standards of living and leisure time. They also provide the means for lowering costs of production which can bring expansion, lower prices, higher wages, or increased profits, singly or in combination. The achievement of these gains is not automatic; it depends on high levels of employment and continued economic growth. Productivity is affected not only by levels of employment and personal consumption, but by the rate of application of new technology, improvements in plant layout, work methods, work flow, material-handling procedures, and other applications of management techniques; changes in volume of production; the development of new products or materials; and the skill, effort, and incentive of the work force." "Output per Man-Hour in Manufacturing, 1939-47 and 1947-53," *Monthly Labor Review*, Jan. 1956.

The total view is a dynamic picture. Reality is made up of a continuing variety of changes in the quality and quantity of new products which are demanded and produced, changes in pay rates, other production costs and selling prices, various types of productive facilities and the introduction of new methods and skills, new materials, and new plant and equipment needed to launch innovations. These and other changes must also be considered to obtain a reasonably full understanding of how automation affects jobs.

In the discussion of the partial view, it was assumed that production and sales remain the same. It is more realistic to expect sales to rise at times and decline at others. Even though automation may reduce labor and other requirements to make a unit of product, employment will actually rise if sales and output increase somewhat faster for reasons such as a shift in customer tastes toward the particular product, lower price, etc. Conversely, a drop in sales and output can lead to layoffs whether or not automation has been introduced. Thus, the ups and downs in sales and production generally have a greater effect on employment than automation, at least in the short run and frequently in the long run as well.

Based on their own particular experience, some people have argued that the major advantage and primary purpose of automation is quality improvement. That is, an automated operation can make products of greater uniformity and closeness to higher specifications or tolerances but still require as much or more labor to do so. To the extent that automation improves the quality-price combination and sales grow more rapidly, jobs are created.

The innovative aspects of automation are perhaps the most important protectors of existing jobs and creators of new jobs. Innovations, or changes in the combinations of labor with other productive resources, generally require new capital investment outlays and lead to expanded uses and applications of existing products and services, new products, and, sometimes, whole new industries.

When we unite the partial and total views of how automation affects jobs, we see (1) that technological advance reduces the labor and/or other productive factors needed per unit of product (the partial view); but (2) that this labor, etc., displacement can be, and often is more than offset by other forces (the total view) which increases sales, production, and employment. The combination of research and development, capital investment programs, automation, and the appropriate work skills, including salesmanship, leads output and employment growth in two broad but related ways:

—quality-price improvements in established products and services encourage their greater use in current applications, make them now acceptable substitutes for other products, and may even pave the way for entirely new products and new industries;

—new products and new industries provide net additions to national income, employment, and a greater variety of goods and services for use and enjoyment.

What has been said thus far about the relationship of automation, employment, and unemployment may be summarized this way: first, there is the displacement effect where individuals may be taken off particular jobs (the partial view) but do not necessarily join the ranks of the unemployed because, secondly, automation, supported by both adequate customer demand and appropriate labor supply, generates the growth effect or the increases in output which preserve and increase the number of jobs. Thus, at any period of time, changes in employment and unemployment depend on the comparative strength of the growth and displacements effects.[3]

"Two Million Jobs Lost Yearly"

At least since the days that French workers threw shoes into machinery to stop the introduction of laborsaving devices,[4] industrial society has seen many instances of anxiety and sometimes antagonism toward technological improvement. The current pessimists have no quarrel with the facts that past long-term technological change has raised our standard of living through rapid rises in output and employment. They express concern, rather, that automation represents an entirely "new industrial revolution." It is argued that the "old" industrial revolution created new jobs and industries but that the "new" industrial revolution is creating two types of problems:

—job opportunities as a whole are expected to shrink relative to the number of job seekers, and

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[3] See appendix.

[4] A practice which contributed a word to the English language: sabotage (sabot—shoe).

[5] A well-publicized version of this estimate was that of John I. Snyder of U.S. Industries, in testimony before a Subcommittee of the Committee on Labor and Public Welfare, U.S. Senate, Oct. 3, 1963.

—the appearance of new jobs which the existing work force will be incapable of filling for such reasons as deficiencies in skills, education, training, mobility, etc.

One oft-repeated assertion of the pessimists is that 2 million jobs are being eliminated each year by automation.[5] What does this mean?

An examination of employment and unemployment trends for the past several years indicates that except for 1958 with its industrial production drop and 1961 with its relatively small increase, civilian employment rose more or less steadily from 65 million in 1957 to about 70.4 million during 1964. (see figure 1).

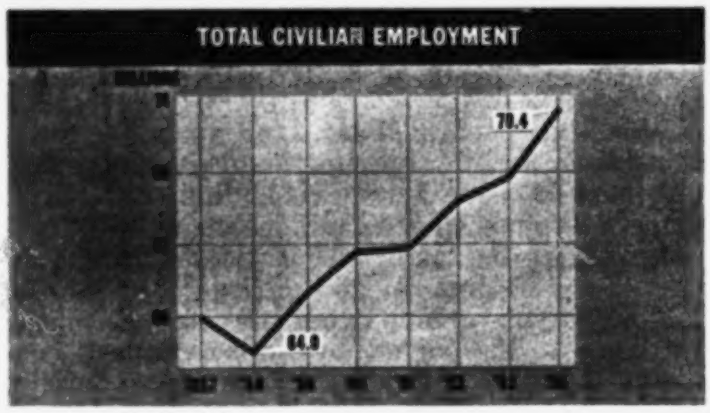

Figure 1.—Total Civilian Employment 1957-64.

Source: U.S. Department of Labor.

Over the same period the number of unempoyed has tended to remain at around 4 million except for the poor business years of 1958 and 1961 (see figure 2).

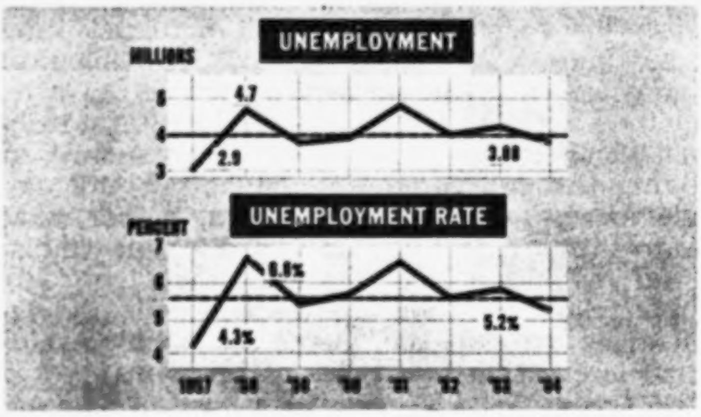

Figure 2.—Unemployment, 1957-64.

Source: U.S. Department of Labor.

During this period the unemployment rate tended to stay stuck at about 5.5 percent during the recovery periods following the economic turndowns.

These facts make two points unmistakably clear. The statement that over 2 million jobs have been lost annually cannot mean that employment declined by 2 million annually, nor can it mean that 2 million more persons have been added to the ranks of the unemployed each year.

What does this "2 million jobs lost yearly" contention mean then? We can begin to place it in proper perspective when we see how such a number was obtained. Using round numbers rather loosely, an assumed 3 percent annual gain in output per man-hour (which is actually much too high for the national economy) is applied to an employed work force of about 70 million.[6] The arithmetic (.03 × 70 million) suggests that some 2 million jobs have become unnecessary.

To progress from this type of argumentative arithmetic to sound economic analysis, the following observations are in order.

First, the 2 million job loss figure is speculative in that it represents only one of several steps required to estimate how many new jobs would have to be created to prevent a rise in unemployment if the economy did not grow (produced the same output) while output per man-hour increased 3 percent.[7] It is highly unlikely that a 3 percent productivity gain can be attained without the same high (plant capacity) operating rates and the new capital expenditures that are required to increase productivity, production, and employment levels. The fact that employment grew while unemployment did not rise over the past few years demonstrates that output gains outpaced the combination of productivity plus labor force increases.[8]

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[6] The familar postwar trend rate of 3 percent annual gains in output per man-hour prepared by the Department of Labor applies only to the private sector of the economy, excluding government. The difficulties in measuring productivity changes in service activities are monumental. However, it is generally held that service productivity gains have not been as large as those in tangible goods production. The latest available comparison of productivity gains in the goods and services sectors of the national economy reveals that ". . . real output per man in the goods sector grew at the rate of 2.4 percent per annum between 1929 and 1961 [while] the corresponding figure for the service sector was .7 percent." Victor R. Fuchs, *Productivity Trends in the Goods and Service Sector*, National Bureau of Economic Research, Occasional Paper No. 89, pp. 1 ff. The author devotes a large part of the study to trying to account for the 1.7 percent sector differential. A comparison of productivity changes by major industry group (table 5, p. 15) leads to the statement that "The range of productivity gains across industries is very large, with communications and public utilities typically leading and general government typically showing the slowest growth." (p. 16)

[7] As a bare minimum, at the aggregate level of analysis, it is also necessary to include such variables as output compared to output per man-hour, average hours of work, and net labor force changes in trying to estimate employment and unemployment level fluctuations.

[8] Productivity gains tend to be high when output is growing more rapidly, and vice versa. Indeed, there is evidence that output growth tends to outpace productivity increases as higher growth rates are attained—see Leon Greenberg, "Technological Change, Productivity, and Employment in the United States," Report No. 2, OECD North American Conference on the Manpower Implications of Automation, Washington, D.C., Dec. 8-10, 1964, pp. 14 ff.

As a result of this tendency, periods of relatively big productivity increases tend to be associated with periods of rising employment, Indeed, in the absence of rising productivity, growth in production would necessarily be less and product per capita lower—economic progress would be essentially frustrated.[9]

Secondly, the 2 million may refer to displacement or disemployment situations where individuals were taken off particular jobs—and, most often move to other jobs. But no one really knows how many displacements actually take place each year. Nor is there any clear impression about the relative importance of the economic, technological, organizational, and other causes of employee displacements. While 2 million seems like a large number of displacements for purely technological reasons (and a smaller number would, very probably, be more accurate) it should not be too surprising when we consider both (1) our very large labor force and (2) the dynamic, progressive nature of the American economy. The key point is that displacements are an integral part of the processes by which economic change and progress occur. The day that displacements cease to occur because of improved methods of production—that day will mark the start of a failing economic system which no longer permits a rising standard of living and the power to compete successfully with other economic and political systems. Also, on the day that technological displacements do not occur or jobs do not "disappear" we will no longer have sufficient labor to shift from declining products to growth products, as has taken place in the past. Thus, while displacements take place because of changing job requirements, the critical thing is that displaced workers as well as new labor force entrants (and reentrants) find other jobs. Job openings appear when replacements are needed for people who stop working (resignations, retirements, leaves of absence, etc.) and because new jobs are being created more or less constantly.

Thirdly, the point that automation or technological change should not be equated with productivity is also relevant here. Mechanization and automation equipment are desired for what they can contribute to productivity gains over the years. Yet, part of any productivity increase—be it 3 percent or another figure—may result from nontechnological factors, (e.g. high versus low output periods) especially over a relatively short span of years. Just as automation cannot be given full credit for all short-term productivity gains, displacements and unemployment have a variety of causes other than technological change.

When these qualifications are considered, the statement that we are losing 2 million or some other number of jobs annually ceases to be frightening. The distinction between displacements and net increases in unemployment as well as the difference between assuming no output growth and observing how much growth is actually occurring are critical to our understanding of employment and unemployment trends.

Automation as a Cause of Unemployment

The main charge made against automation seems to be that it creates problems of labor force adjustment far greater than any we have come through in the past. The critics concede that past technological change has meant economic progress, and that the economy has absorbed displaced labor through growth. But, it is said, automation proceeds so rapidly and radically that labor force adjustment cannot keep pace. As a result, it is charged, automation creates a pileup of the unemployed.

If true, this serious charge would suggest that certain distinct trends could be identified in available statistics on unemployment—among the unskilled blue-collar workers, those in manufacturing, those in depressed areas, and those out of work for extended periods. Thus, these assertions may be tested by examining the statistics.[10]

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not declines. In the abstract, all other things being equal, the effect of increased productivity is to require less employment for a given output. But in practice, experience shows that the employment-increasing effect of output growth more than offsets the employment-reducing effect of higher productivity.

[9] General Electric's chairman of the board Gerald L Phillippe recently told an audience:

"Without constantly improving machines, I submit that:

"1. Jobs would be plentiful perhaps—but arduous, boring, and extremely low-paying;

"2. Industry could not possibly produce what U.S. customers require—not in quantity, not in quality, and not at a price that people will pay;

"3. Competitively, America would disappear from the world scene.

"The only real security any of us can have—as a company, as an industry, as an economic society—is to achieve competitive costs, worldwide, through improved productivity."

[10] The discussion which follows is based on the analytical techniques and statistics (updated where possible) developed by R. A. Gordon, University of California, in "Has Structural Unemployment Worsened?" *Industrial Relations*, May 1964, pp. 53 ff.; see also the Feb. 1965 issue, pp. 111 ff. The Bureau of Labor Statistics, U.S. Department of Labor, regularly publishes data dealing with the percentages of total unemployment accounted for by particular occupations, industries, age/sex groups, etc. However, one of Professor Gordon's contributions is to provide the analytical rationale for using these (fraction of total unemployment) statistics as indicators of labor force adjustment. With U representing a total unemployment, the labor force, and the subscript i referring to a specific labor force group designations such as manufacturing, white collar workers, etc., Professor Gordon's identity is:

$$\left(\frac{Ui}{Li} \div \frac{U}{L}\right) \times \frac{Li}{L} = \frac{Ui}{U}$$

If i represent (say) blue-collar workers, the statement is that the fraction of total unemployment represented by blue-collar workers, $\frac{Ui}{U}$, is equal to the ratio of the blue-collar unemployment rate $\frac{Ui}{Li}$ to the overall unemployment rate $\frac{U}{L}$, weighted by the blue collar representation in the total labor force $\frac{Li}{L}$. Thus, comparisons of the percentages of total unemployment represented by the several labor force groups over selected years reflect (1) how a group's unemployment rate compares with the national rate and (2) the changing importance of the group within the labor force.

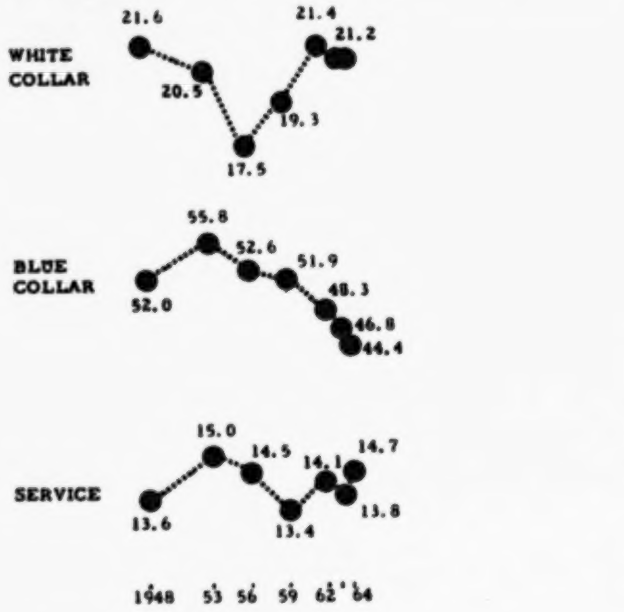
By themselves sharp rises or declines in particular group unemployment rates tell us little about how a particular group has been affected by such phenomena as automation or how effective the labor

Figures 3–6 show the fraction of total unemployment represented by specified work force groups during selected years.[11] These years have been chosen so as to exclude years of economic recession when the predominant cause of unemployment was a slowdown in business activity generally. Since we want to understand the impact of automation, not of recession, only years of high business activity have been selected.

Blue Collar and White Collar Unemployment

For example, consider the assertion that automation is creating jobs which can be filled by skilled workers while the less skilled remain unemployed. If this were true, we should expect to find that unskilled blue collar workers account for growing percentages of the unemployed, while white collar and service occupations represent progressively smaller percentages.

Figure 3 shows the occupational groupings of the unemployed based on the last job held.



Fractions of Total Unemployment for Other Occupational Groups (1964)
- No previous work experience 16.0
- Farm 3.7

Figure 3.—Percentage of total unemployment accounted for by each major occupational group (selected years).

Source: Figures 3-6 based on Bureau of Labor Statistics data.

It is interesting to note that over the last few years the blue-collar share of total unemployment is noticeably lower than in previous years; since 1953 it has declined steadily and significantly.

While white-collar unemployment rates have remained relatively low and their employment has been generally growing throughout the postwar period, we see that the fraction of unemployment represented by white-collar workers has been rising since 1956.

Although throughout the whole postwar period the unemployment rates of service workers have been generally falling relative to the overall unemployment rate, their more or less stable share of total unemployment, around 14 percent, is ascribable to their growing importance in the labor force.

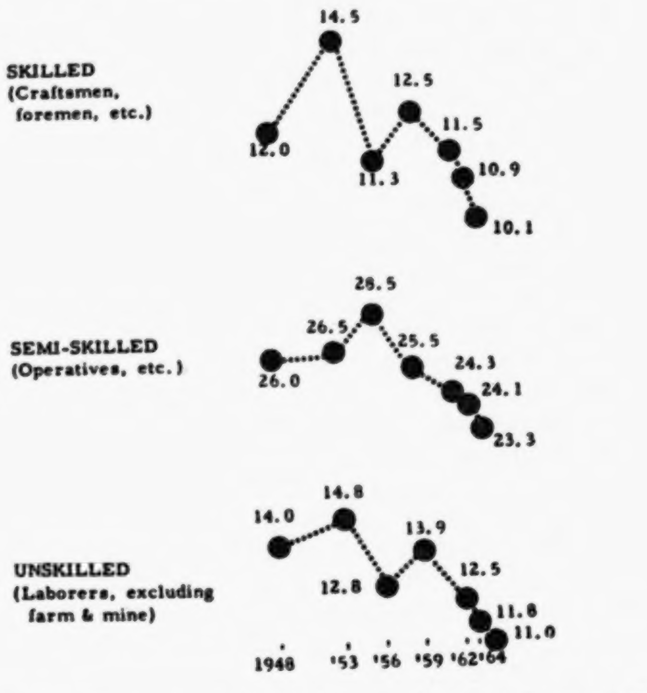


Figure 4.—Percentage of total unemployment accounted for by blue collar workers according to relative degree of skill (selected years).

Now note the blue-collar group in more detail. Sometimes it is alleged that unemployment has been growing increasingly severe among the unskilled blue-collar workers, and perhaps the semiskilled—in fact, most casual observers of the economic scene almost assume that this is true. It is true that unskilled laborers have unemployment rates which are almost twice as high as the national average; to repeat an obvious and familiar fact, highly qualified workers have always had an easier time finding and holding jobs than those with less to offer. Yet the proportion of unemployment accounted for by unskilled and semiskilled blue collar workers has been declining persistently in recent years (see figure 4).

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force adaptation to the phenomenon has been. A rise in a specified group's rate when compared with the overall unemployment rate may show that the group's "relative unemployment rate" (Gordon's term) has not risen so that the prevailing structure of unemployment rate differentials remain unaffected. Further, even if a group's relative unemployment rate climbs upward, it need not spell a "structural unemployment" problem if (1) the group represents a declining proportion of the total labor force, (2) other labor force groups can absorb most of the displaced workers, and (3) labor force participation rates do not decline significantly as a result of prolonged unemployment.

[11] All of these charts have been plotted on a uniform ratio (semilogarithmic) scale.

Thus, the statistical record shows exactly the opposite of what we would expect to find if automation were causing the adjustment problems for blue-collar workers that some have attributed to it. The point is that while the blue-collar unemployment rate has maintained its comparatively higher relationship to the overall unemployment rate, the percentage of blue-collar workers in the labor force has been declining fairly steadily so that they represent a declining fraction of total employment. This suggests that, the pessimists to the contrary, labor force adjustment is still both viable and vigorous with the displaced finding jobs elsewhere.

Goods and Service Industries

If automation hits goods industries far more than those which render services, as some have asserted, we should expect to note severe work force adaptation problems in manufacturing.

The manufacturing panel on figure 5 shows that manufacturing's share of total unemployment has been dropping continuously since 1956. During years of high level economic activity, the unemployment rate in manufacturing is only slightly above the overall unemployment rate. Manufacturing's decreasing share of total unemployment is partly explainable by the fact that it now accounts for a smaller fraction of the labor force than it did about 15 years ago.

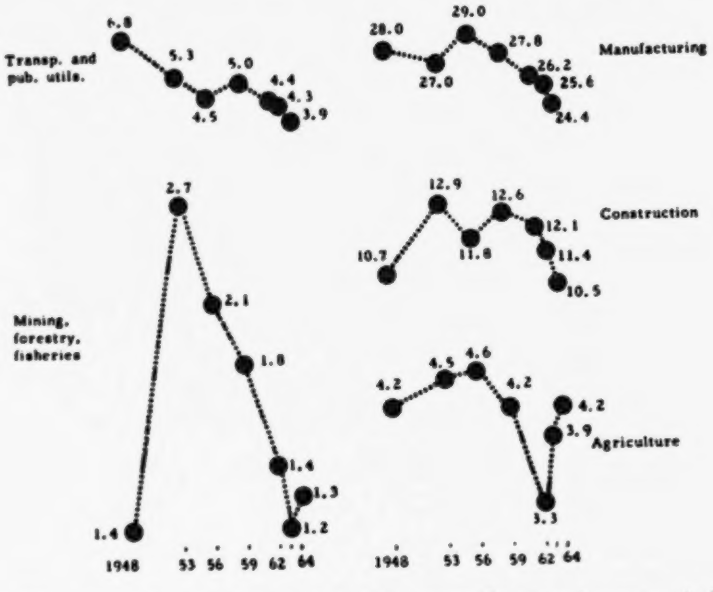

Figure 5. Percentage of total unemployment accounted for by primarily "goods" producing industries.

The important point for our purposes, however, is that once again, automation seems absolved of creating the labor force adjustment problems which lead to massive unemployment.

In contrast, faced with rapid growth in demand, the service industries appear to be facilitating work force adjustments by absorbing workers, as the long-term trends suggest they should. The growing proportion of the labor force made up of service workers with their below average unemployment rates strongly suggests that the service industries have been drawing labor from other parts of the economy as well as from additions to the labor force. Thus, it is not too surprising that a relatively small increase has occurred in the fraction of total unemployment assignable to basic service industries and trade (see figure 6).

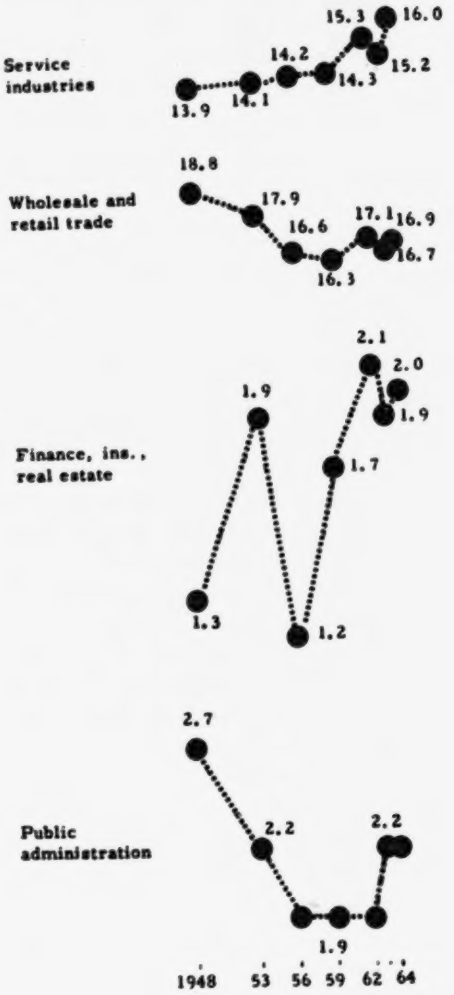

Figure 6.—Percentage of total unemployment accounted for by primarily "service" industries.

The agriculture and mining, etc., data in figure 5 merely remind of the fact that there has been a dramatic long-term progressive slide in both employment and unemployment in industries which draw their products from the earth, so that the extractive industries account for a very small fraction of unemployment today.[12]

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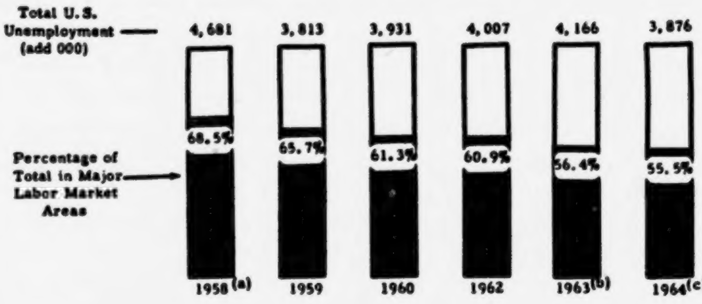
[12] In examining the case against automation, we have tested the usual assumption that the impact of automation is to be found in manufacturing. Actually, as a recent study by the Machinery and Allied Products Institutes (George Terborgh, "The Automation Hysteria") points out, the most important applications of auto-

Depressed Areas

It is sometimes argued that as a result of automation, some particular areas have become depressed, with increasingly concentrated unemployment over the years.



a) Figures available for only 147 areas.
b) Figures available for only 149 areas.
c) Preliminary (11 month) average.

Figure 7.—Percentage of national unemployment found in 150 major labor market areas.

Source: Figures 7-9 are based on pp. 119-21 of Otto Eckstein's article "Aggregate Demand and the Current Unemployment Problem," in *Unemployment and the American Economy*, Arthur M. Ross, ed. John Wiley & Sons, 1964, and the *Manpower Report of the President*, 1965, pp. 243-245. Professor Eckstein of Harvard University is now serving as a member of the Council of Economic Advisers.

From examination of a number of years of data dealing with the 150 major labor market areas, we are in a position to judge whether such areas represent greater, stable, or declining fractions of national unemployment.

Figure 7 shows that year after year, the 150 labor markets contain smaller fractions of the unemployed. It appears that the unemployment is becoming more widely dispersed across the Nation rather than building up in a relatively few areas.

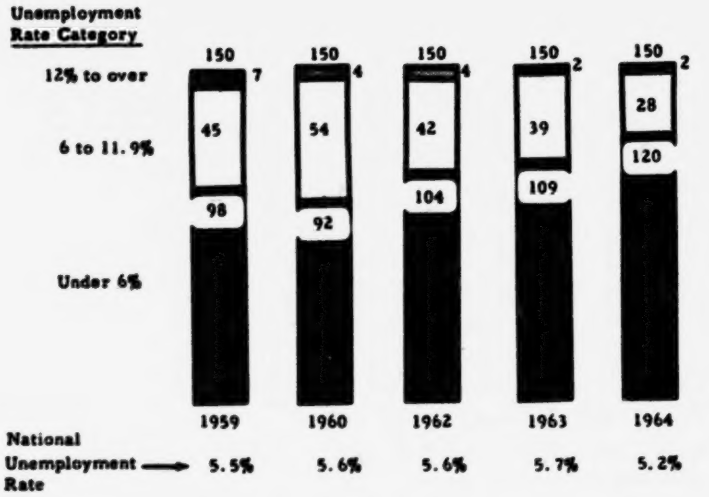


Figure 8.—Number of major labor market areas according to unemployment rate category.

In addition, unemployment is becoming less severe within the 150 labor market areas. Figure 8 shows the 4 most recent full years when the unemployment rate stayed within the narrow range of 5.5 to 5.7 percent. While the overall rate was relatively stable, out of the 150 labor market areas, the number with less than 6 percent or higher rates rose more or less steadily. The number with 6 percent or more diminished—from 58 to 41 in 1963. Of course, the greatest improvement occurred during 1964 when the national unemployment rate dropped to 5.2 percent; the number of areas with 6 percent or more fell to 30.

Finally, within the 150 labor market areas, the percentage of the unemployed with lower than 6 percent unemployment rates rose from about 62 percent in 1959 to about 70 percent in 1963 (see figure 9). The fraction of total unemployment with 6 percent or higher rates declined accordingly.

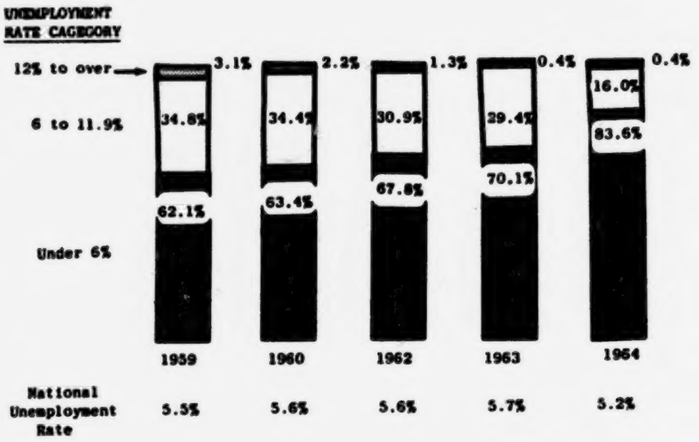


Figure 9.—Percentage of total unemployment in 150 major labor market areas according to unemployment rate category.

All in all, the occupational and industrial distributions of unemployment show that workers in the jobs and industries which are supposed to come to be most susceptible to automation generally represent a declining rather than a rising fraction of the unemployed. The meaning of this decreasing share of unemployment is that workers who have been temporarily or permanently displaced from specific jobs with individual firms have generally become reemployed. They have either gone back to their old jobs because of improving business conditions and growth or have found new jobs, as is typical within the ongoing process of labor force adaptation. Consequently, there is little evidence for the assertion that automation has

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mation may have taken place in data processing, information storage and retrieval, accounting, and related functions—that is, more in office-type work than in factories. Applications of automation to straight production, while isolated examples can be dramatic, have not really taken hold very widely.

been causing a buildup of the unemployed. This generalization applied to occupations, industries, and the older major labor market areas.

Long-Term Unemployment

Look more specifically at the long-term unemployed. To believe the theory that automation has created insoluble adjustment problems, we should expect to find white-collar and service workers representing a smaller portion of the long-term unemployed while blue-collar workers represent a larger share. Figure 10 shows that the opposite is true. From 1957 to 1964 the white-collar share of long-term unemployment rose from about 17 to over 23 percent, while the blue-collar fraction declined from about 58 to under 47 percent. The share of long-term unemployment represented by service workers have varied slightly around the 14 percent mark.

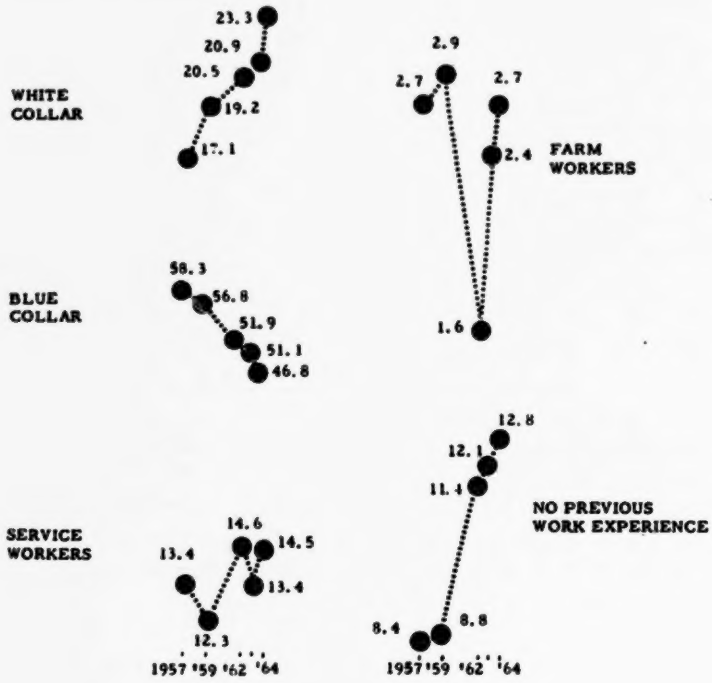


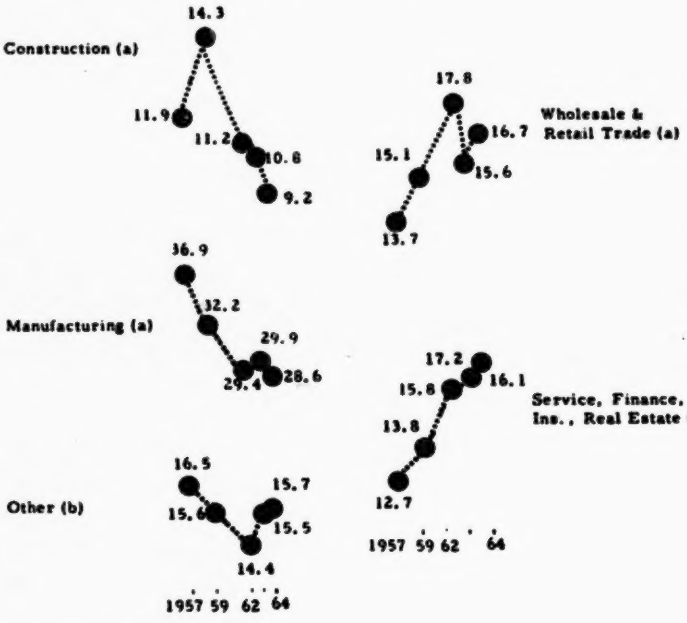
Figure 10.—Percentage of total long-term unemployment (15 or more weeks) accounted for by each occupational group.

Source: Bureau of Labor Statistics data.

The most dramatic change in the composition of those who have been unemployed for more than 15 weeks appears among those without previous work experience.

Turning to a comparison of long-term unemployment by industry (figure 11), we find that goods-producing industries, such as construction and manufacturing, represent generally declining portions of the long-term unemployed, while the trade and service industries were generally on the rise.

Judging by the occupational and industrial characteristics of the long-term unemployed, then, it is abundantly plain that long-term unemployment has not increased among those groups of workers that were purportedly most affected by automation since 1957. Once again, we have strong indications that the labor force adjustments required to move workers from industries and jobs susceptible to employment declines into areas of employment growth has been occurring in a significant way.



(a) Wage and salary workers only.
(b) Includes agriculture, self-employed and unpaid family workers, and wage and salary workers in forestry, fisheries, and mining; transportation and public utilities; and public administration.

Figure 11.—Percentage of total long-term unemployment (15 or more weeks) accounted for by each industrial group.

Source: Bureau of Labor Statistics data.

Clearly the available evidence indicates that automation has not been creating problems of labor force adjustment and unemployment as the automation pessimists would have us believe. While there is always room for improvement, the labor force adaptation process continues to be as persistent and widespread as the other forms of sweeping change throughout our economy (e.g., population growth, amounts and patterns of total spending, technological advance, foreign competition, tastes, values, and judgments about our personal and national goals) which necessitate job changing. Both the statistical evidence and the urgency of automation make it inappropriate and futile to scourge automation as the impediment to a fully employed and rapidly growing economy.

Causes of Unemployment: Some Promising Areas for Study

Unemployment is a serious problem, even if we cannot cast automation as the villain of the piece. Excessive unemployment—persistently over 4 percent of the labor force despite an uninterrupted boom—can represent a searing human problem to the individual man out of work and a major national concern to a free economy committed to economic growth and progress.

This paper cannot begin to cover the complex question of the causes of unemployment. However it may be appropriate at this point to identify a few areas where further study could be productively directed in efforts to understand the causes of unemployment.

1. One important factor affecting employment and unemployment is the rate of growth in the volume of output and sales. With an expanding labor force, a period of relatively slower growth normally will generate a higher unemployment rate. Thus, for example, in the period 1947-57 the rate of growth in output[13] was 3.7 percent per year; in 1957-64, the annual rate of growth slackened to 3.0 percent. Not surprisingly, unemployment increased from 4.2 percent in the former period to 5.7 percent in the latter.[14]

2. Another factor at work in this same period is the rate of growth in the labor force. In a period of rapidly growing labor force, the economy must either grow faster or experience a rising level of unemployment. Thus one further reason why unemployment averaged higher in 1957-64 than in 1947-57 was that the civilian labor force expanded at a somewhat faster rate (1.4 percent versus 1.1 percent yearly).

This factor of labor force growth is an extremely important factor right now and for the immediate future. The big surge in numbers of babies born right after World War II is just now hitting the labor force as these people reach the ages of 18–21. One of the critical problems facing the country in the next few years will be to expand job opportunities fast enough to absorb unusually large numbers of young people entering the labor force.

3. An additional factor affecting employment and unemployment is the changing composition of total demand. The well-known trend toward greater proportional demand for services compared to goods (especially food and clothing) carries with it greater needs for service workers and a lesser demand for those in farm and factory occupations.[15] Similarly, both the magnitudes and types of defense spending go a long way in accounting for the higher employment levels in the white-collar and skilled occupations, while the lower-skilled and blue-collar jobs lag behind or even decline in some instances.

A Bureau of Labor Statistics study, "Employment Impact of Changing Defense Programs," (*Monthly Labor Review*, May 1964) has pointed out how new types of military spending have affected job opportunities for workers in defense industries:

> In the five major defense related industries, production workers fell between 1958 and 1963 from 64 to 57 percent of all workers . . . compared to a drop of only 1 percent (from 75 to 74) for all U.S. manufacturing. Another evidence of changing occupational patterns in defense work comes from a recent survey covering several hundred thousand employees in plants making aircraft, missiles, and space vehicles. Between 1955 and 1961, hourly employees fell from 75 to 64 percent of the total number of workers surveyed while engineers, scientists, and technicians increased from 14 to 22 percent.

4. Any analysis of employment and unemployment trends must include a discussion of the "price." More specifically, the differing compensation costs of employing different labor skills in various industries obviously will have some effect on hiring patterns. Just as prevailing prices influence the quantities of goods and services both that purchasers demand and that sellers supply, in the same way, pay and benefits affect both (1) the numbers and kinds of employees that firms hire and (2) the supply of labor (the labor force). Thus, for example, higher pay and benefits levels tend to discourage the demand for labor while at the same time increasing the number of job seekers.

The point that fast wage increases may adversely affect job opportunities invariably raises controversy and emotional responses. Nevertheless, logic and evidence alike would suggest that any careful inquiry into the causes of unemployment must include an examination of this point.

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[13] As measured by gross national product in constant dollars. These rates were obtained by using the equation

$$\log y_t = a + bx_t + cz_t,$$

where $x_t = 1, 2 \ldots 11$ from 1947-57 and had the constant value of 11 from 1958-64 and $x_t = 0$ from 1947-57 and $1, 2 \ldots 7$ from 1958-64.

[14] Arithmetic average of annual unemployment rates over the two periods.

[15] Former Bureau of Labor Statistics Commissioner Ewan Clague stated: "A very large part of the increase in professional workers has been due to population growth. For example, a greater number of teachers are needed to serve the rising number of school-age children; and the large increase in medical personnel is resulting from our growing population with its changing age distribution and increasing willingness and ability to pay for medical services. . . . The different rates of unemployment growth among industries have been the most important single factor determining the occupational distribution of employment has resulted from greater-than-average growth in industries employing large numbers of these workers; for example, State and local government; finance, insurance, and real estate; trade; and business and professional services; coupled with the much slower growth in industries in which smaller numbers of white-collar workers are employed—mining, manufacturing, and transportation." "Effects of Technological Change on Occupational Employment Patterns in the United States," Report No. 5, OECD North American Conference on the Manpower Implications of Automation, Washington, Dec. 8-10, 1964, pp. 3-4.

The Positive Value of Automation

It is extremely important that clearer perspective be gained on the relationship of automation, employment, and unemployment. Lack of understanding on this point could lead to formal or informal restraints on the pace of automation. Such restraints could seriously jeopardize the needed positive values of automation. Such positive values relate to a rising standard of living, intensified competition, and the national defense.

Rising standard of living. Comparisons of the economic well-being of different nations are sometimes expressed in terms of how many hours of work, on the average, are required to buy a given product or service. It is a source of pride and satisfaction that the average hour of work will command more goods and services in America than in just about any other nation because we currently produce more in an hour. Facing the future, it is an inescapable fact that if we want an hour of work to buy still more goods, we must be capable of obtaining that additional output from an hour of work.

Stated more fully, a rising standard of living depends on continuing gains in efficiency or productivity. Each hour of work, each piece of capital equipment, each unit of raw material, each foot of floor or land space must be made to yield progressively greater output. Over the decades, productivity increases have primarily come from the combination of advancing technology and upgraded human skills. Our economic future depends on rapid gains in the quantity and quality of both types of productive resources.

Solutions to our poverty problems hinge on making it possible for more people to contribute to, and thus share in, a larger output of the necessities and luxuries of life. The expanded use of modern technology—and much-maligned automation—gives us an effective tool for coping with urban slums and congestion, inadequate educational facilities, and other social problems. Without improving productivity, we cannot deal with these problems successfully.

Intensified competition. As long as we believe (justifiably) that a free enterprise system provides the most effective means of producing and distributing the goods and services which make up our level of living, businessmen—and, indeed, nations—will compete to make and sell more and better goods at lowest prices. Automation is introduced and furthered in an effort to secure a winning edge over competitors. Slowness in updating production facilities and penetrating new markets can mean the difference between business success and business collapse. The loss of jobs and income because a business fails to compete successfully represents a very significant form of technological unemployment. Using the closing of the Studebaker plant to illustrate the complexity of causes of unemployment, Dr. Ewan Clague, former commissioner of the Bureau of Labor Statistics, stated:

> It [the Studebaker plant] was an old plant which did not rank high in automated equipment. An important cause of the shutdown was a lack of sales, over which neither management nor labor in the plant itself have much control. In fact, it might be argued that automation as such had little or nothing to do with that closing. Yet in another sense, it could be considered a cause because it may have been technological advances elsewhere in the industry which reduced the South Bend plant to nonprofitability.[16]

Today the march of technological advance is worldwide. The adoption of automation by more countries means that both the sources of production and the markets for many goods are now on an international rather than just a national scale. Time was when certain areas of the United States were recognized as the leading worldwide suppliers of particular products. How quickly things can change is suggested by the drop in America's share of major (nonmilitary) manufactured goods sold by the principal industrial nations in world markets from over one-fourth to just under one-fifth in just the last 10 years.

Today the race is to the swift—and the stakes in the domestic and international automation competition are high: to the leading firms, industries, and nations will go the fastest rises in income, jobs, and general economic prosperity.

National defense. The worldwide acclaim that greeted the Russian launching of Sputnik I on October 4, 1957, provided dramatic evidence that science and technology are instruments in the cold war battle for the minds of men that is raging between democratic capitalism and dictatorial communism. Perhaps more than ever in the past, the respect granted a nation depends on its demonstrated ability to raise living standards and defend itself if necessary. Sputnik symbolized the fact the nation or group of nations with the highest capabilities in science, technology, and automation stood the best chance of enriching and protecting the lives of citizens.

Automation makes very significant contributions to national defense in two ways. First, for example, computers are extremely valuable in the design, construction, and operational use of the many modern weapons ranging from radar to rockets. Computers outpace humans in making the very large numbers of high speed and precise calculations that are required in all phases of modern weaponry. Secondly, automation may help in partially overcoming the labor shortages that occur during defense emergencies so that the civilian standard of living can be maintained. Automation is necessary to have both "guns and butter." With modern wars involving the whole populace, modern production methods are the order of the day.

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[16] Ewan Clague, "What Employment Statistics Show" *Automation*, Apr. 1964, p. 55.

If Khrushchev's successors "bury" us under a flood of goods or a string of bombs, it may, very possibly, be because they can prove that their kind of economic system encourages and achieves higher rates of technological progress than "the decadent capitalistic order."

In the light of (1) our desire for a rapidly rising standard of living, (2) the realities of domestic and foreign competition, and (3) peace on earth and in space, the real "problem" of automation may very well be, "Is automation occurring rapidly enough?"

Public Policy on Automation

Public policy with respect to automation is a matter of obvious interest in view of the many proposals advanced from time to time which attempt to deal with the effects of automation. These include:

- —proposals which proceed from the assumption that automation is a major factor in creating the current unemployment problem;
- —proposals which promote education and training in order to equip the labor force with new skills needed for an age of advancing automation;
- —proposals which encourage industrial expansion and national economic growth in general or business investment in particular, including investment in modernizing automation equipment.

Some Mistaken Approaches

There is widespread concern that the unemployment rate of recent years has been needlessly high. If wise policies can be instituted, most economists believe, our economy should be able to reduce this rate significantly and, in doing so, help alleviate both the drain on U.S. productive capability and the personal hardship on individuals which unemployment represents.

In understandable concern about unemployment, however, some of the critics of automation seem to imply that the cure for unemployment must be found in slowing down or at least regulating the further introduction of automation. Actually few serious proposals are advanced at the policy level to impose specific constraints on the introduction of technology. Nevertheless the scare images invoked of automation as a job-destroyer and "curse" on society have the practical effect of stimulating public and employee anxiety about and even opposition to the spread of new technology.

But, as we have seen, the evidence suggests that excessive unemployment cannot be attributed to automation. Thus measures to discourage automation would seem a most unpromising approach to the reduction of unemployment, and, in view of the positive benefits of automation, a potentially damaging path to follow.

Another brace of "solutions" to unemployment is built, like the 2-million-jobs-lost-per-year arithmetic discussed above, on still another new version of "political arithmetick." [17]

To balance the 2 million jobs per year which are purportedly "lost" through automation, some of the same political arithmeticians have come up with two new pieces of arithmetic which are supposed to show how large numbers of jobs are to be "created" through such measures as the shorter workweek, the shorter work year and higher pay premiums for overtime work. The stated objective of such measures is to "spread" the work by making it preferable for employers to hire new employees rather than offer longer hours to those already employed.[18]

Thus, we are now given numerical calculations which purport to show how many new jobs would be "created" by reducing the workweek by a specific number of hours (or a changing number of hours which varies with the severity of unemployment over the business cycle—the so-called "flexible" workweek proposals). The number of man-hours "opened up" by the workweek reduction is divided by the new basic or reduced workweek and the result is supposed to represent the number of new jobs "created" or the amount by which unemployment might be decreased. The same process of adding and dividing of man-hours is also used to justify the higher pay premiums which are supposed to provide the penalties or disincentives required to sharply reduce overtime work: all the overtime hours worked in plants across the Nation are added up and then divided by 40 hours to arrive at an estimate of the number of jobs that are supposed to appear because of "elimination" of overtime.

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[17] Students of the historical development of economic doctrines regard the English economist Sir William Petty (1623-87) as one of the most important contributors to the development of modern economics. One of Petty's contributions is described by Eric Roll in this way: "In his *Political Arithmetick*, written probably in 1672 and published in 1690, Petty states explicitly a new approach to economic inquiry which he knows to be still unusual. 'Instead,' he says, 'of using only comparative and superlative Words, and intellectual Arguments, I have taken the course . . . to express myself in Terms of Number, Weight, or Measure; to use only Arguments of Sense, and to consider only such Causes, as have visible Foundations in Nature.' Petty truly adhered to this manifesto of empiricism; and his claim to fame is generally conceived to rest on the part he played in the foundation of a science of statistics. There can be no doubt that Petty is rightly regarded as the first to develop this sister discipline of political economy." Eric Roll, *A History of Economic Thought*, 3d ed., Prentice-Hall, Inc., 1956.

By contrast, the modern version of "political arithmetick" discussed above involves the use of over-simplified arithmetic calculations as a substitute for rigorous economic analysis which draws heavily on the relevant facts. It is "political arithmetick" in the sense that seemingly scientific analyses are used in an effort to generate widespread appeal for a proposal without fully discussing the fatal defects inherent in the proposal.

[18] The relevance of this discussion to the question of automation may be seen from the fact that the President's 1965 message to Congress on labor legislation, in explicitly rejecting shorter workweek proposals, referred the whole question of "work periods" to the Commission.

Unfortunately, however, the labor force does not consist of homogeneous units which can be freely substituted for each other. When an employer in San Francisco needs some extra hours of highly skilled labor, he cannot hire an equivalent number of unskilled West Virginians who happen to be unemployed. Furthermore, if the need for extra hours of work is temporary, it may be highly unworkable to call in new people as against offering overtime to present employees.

To be more specific, the jobs computed under this political arithmetick will "add up" only if enough unemployed people with the required skills are available, willing, and able to work at those jobs where longer hours are currently being worked. In other words, we must take another look at the additional available labor supply which the unemployed comprise.

During May 1965 almost one-half of the unemployed were under 25 years of age and almost one-fourth of the unemployed had no previous job experience and were in search of their first job. With the largest single group of the unemployed consisting of young, inexperienced, and untrained persons, it is indeed questionable whether they are suitable candidates for the jobs that would be theoretically created by a shorter workweek or a major reduction in overtime work. In fact, one of the most frequent reasons for overtime is that many plants are currently experiencing great difficulties in obtaining qualified workers.[19]

Another look at the unemployment statistics sheds more light on the growing tightness of labor markets. Against the seasonally adjusted average national unemployment rate of 4.7 percent during June 1965 must be compared to the 3.2 percent unemployment rate for all men 20 and over and the 2.4 percent unemployment rate for married men. For women 20 years and over the 4.8 percent rate was virtually the same as the 4.7 percent national average. By sharp contrast the teenage unemployment rate was over 14 percent. Considering the fact that the labor force contains almost twice as many men as women, the 3.2 percent and 4.8 percent unemployment rates just cited point to the fact that the overall average unemployment rates for adults is somewhat below the 4 percent interim full employment rate target enunciated by the Council of Economic Advisers.[20]

More than ever it is very clear that our unemployment difficulties center around the growing numbers of young, unskilled, inexperienced, and untrained persons. This being the fact, it is virtually impossible to understand how basic workweek and overtime hour reductions can create anything substantial in the way of additional hirings.

The various spread-the-work proposals contain an ever more fundamental error, of course, in their basic economics. Such proposals attempt to expand the demand for labor by raising its price. It is difficult to understand why anyone should expect that more labor will be employed when the employment costs of making a unit of product go up. No matter how well-intentioned, proposals which seek to help the unemployed by raising the cost of being employed will not achieve their objective.

The primary danger inherent in a short workweek, the flexible workweek[21] or sharp penalties on overtime, if actually brought about, is that of halting the current 50-plus month economic expansion by unstabilizing the labor cost structure of our economy. Any current reduction in the workweek or increase in overtime penalty rates must raise unit labor sharply in out or both of two ways. First, with the growing shortage of adequately skilled hourly employees, a shorter workweek means that many more hours would have to be worked at overtime premiums in order to maintain current levels of production. Secondly, even with an excessive increase in overtime, employers might be forced to hire unqualified or less-qualified workers so that the prevailing pay rates given for less-than-adequate productivity would in effect amount to an increase in pay rates and unit labor costs. Such labor-cost inflationary pressures are not unprecedented and can persist as long as customers are willing to pay higher prices for products. Our postwar history shows that in the absence of sustained wartime demand, inflationary surges lead to recessions and much more severe unemployment than we are currently experiencing.

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[19] See General Electric statement to congressional committees considering double overtime legislation: "Why Double Time for Overtime Would Hurt Employees, Economy."

[20] This statistical computation which excludes youngsters is merely intended as an analytical device to show where unemployment is most highly concentrated—among youngsters—rather than to minimize the severity of this unemployment problem. Another danger in looking only at national statistics is that a 4 percent overall rate tends to mask such serious problems as (say) an 8 percent unemployment rate among nonwhites.

[21] The flexible workweek provides a particularly vivid illustration of perverse economics. Under this proposal, when sales and output decline, the workweek would be reduced but weekly pay maintained (so as to maintain purchasing power). The purchasing power maintenance argument is understandable and correct up to a point. However, it is axiomatic that constant income to employees for a declining amount of work amounts to higher costs to employers and, inevitably, higher prices to consumers which they may or may not choose to pay. And the more sales and output decline, the greater the upward pressure on costs and prices—the more business sales slacken the more costs are raised. The hoped-for maintenance of purchasing power fails to materialize because of offsetting reductions in employment. What good is a plan to guarantee weekly take-home pay when the effect of the plan is to take people off payrolls? It is difficult to envision a device which runs more effectively counter to what is needed: It is like trying to stop a car that has begun to roll down hill by hitting the accelerator (price rises) instead of the brake.

To make matters worse, an increase in the overtime premium from 1½ times to double the basic pay rate would further magnify the labor cost pressures of trying to provide more man-hours during an already serious labor shortage. It seems hardly sensible to try to reduce our overall unemployment rate by 1 percent by taking a course of action which could probably lead to another recession and thereby much higher unemployment rates.

It should be clearly understood that a reduction in working hours brought about by workweek and overtime cuts are not opposed on moral, ideological, or emotional grounds. Rather, the tests of suitability at a given time are essentially those dealing with whether the decreases in hours worked help us attain full employment and the affluence stemming from a higher economic growth rate or whether the proposed changes actually work to defeat these employment and income objectives.

Further, it is also not argued that we will never be able to reduce the average number of hours worked in our society. Quite the contrary, the historical decline in hours worked per week and per year provide grounds for optimism and encouragement that we may earn even more leisure in the future. The critical word is earn because we must further increase productivity and output to the point where we can have both more goods and services and more free time to enjoy them as well as other pursuits. When, then, may or can working hours be reduced without endangering our economy and our national security? The answer essentially depends on the following three considerations:

(1) We will work fewer hours when we make the conscious decision to take a larger portion of our rising incomes in the form of more leisure;

(2) Shorter hours become increasingly realistic when we can demonstrate that we are capable of sustaining an economic growth rate which is high enough to attain both our domestic and international objectives of affluence and peace; and

(3) Shorter hours are earned and properly paid for (i.e., they do not disrupt cost-price relationships) when the added costs of shorter hours plus other desired compensation increases are within the limits of productivity gains so that sudden and excessive rises in unit labor costs do not take place.

Positive Policies Toward Automation

Measures to deal with unemployment can hope for more success and more general support if they are based on a recognition of the positive values of automation. In fact, positive public policies toward automation can well make a significant contribution toward the alleviation of unemployment problems. Such positive policies would have as their aim:

—a high and sustained rate of economic growth, and

—an acceleration of education and training.

The fundamental condition for expanding job opportunities is a flourishing economy. A high rate of economic growth depends on a continuing rise in the demand for goods and services by consumers, industry, and government. In a risk-taking, profit-oriented enterprise economy, business investment for plant and equipment—including automated plant and equipment—constitutes the most critical form of spending. This is so because business outlays are initiating forces in the production processes which create the jobs that yield the wages, salaries, and other forms of income used to purchase a standard of living. In addition, business outlays which enhance the productivity of industrial facilities, as automation attempts to do, contribute to a faster rate of growth. Thus, at the core of any effort to encourage growth, increase employment, and reduce unemployment must lie a widespread determination to encourage the expansion of industrial activity.

Much can be learned from the more or less uninterrupted upward movement of our economy over about the last 50 plus months—one of the longest peacetime expansions in our history. On the average, costs and prices have remained reasonably stable, at least until recently; employment has grown and unemployment is on the way down. Thus far, the inflationary boom and bust and major industry strike situations which were associated with the four postwar recessions have not occurred. Perhaps the current smooth upward economic advance can be taken as evidence of greater public, labor, and management understanding of the folly of pay-plus-benefits increases which create excessive pressures on the cost-price structure.

It is well to note one obvious fact about our current unemployment problem: the fact that the unemployment rate has been moving in the right direction. From a rate of 6.7 percent in 1961 to 5.7 percent 2 years later to 5.2 percent in 1964 and in 1965 to below 5 percent. This sometimes seems frustratingly slow progress—but it is progress, not retrogression. In our zeal to accelerate progress, we must take care that any new steps do not jeopardize continued progress. We want to continue doing those things which have been helping to bring unemployment down. The problem is not so acute or discouraging that we should risk the jobs of many of the 70 million people in an uncertain effort to provide another 1 million jobs.

Yet still, though we have been moving in the right direction, there is general agreement that the employment picture has not been good enough. Unemployment is still too high. What else is to be done?

One highly important development can be the further upgrading of the Nation's education and training processes. Here truly is the key to upgrading the personal skills and performance which the labor force needs in an age of advancing automation.

There is the strong possibility that historians who look back at the 1960's will describe the decade as having a rebirth of education and training. There has probably never been another era when the value of up-to-date knowledge was so widely recognized. Many factors are involved: changing job requirements brought on by automation and other advances; the responsibilities of citizenship in a world tied more closely together by science and technology; and about half a nation under 25 years old. Truly education has become one of our most vital needs. There are daily announcements of training programs being started by community groups, business firms, and local, State and Federal governmental agencies. Despite certain problems, all of these efforts are desirable and essential to a rapidly growing economy headed toward full employment.

More and more business firms especially are recognizing the stake which every company has in encouraging its present employees to improve their job skills. The socially responsible employer today gives every encouragement to his employees to upgrade their skills continually. This may be seen especially among producers of automation equipment. At General Electric, for example, one of every eight employees on the average is taking some kind of training or retraining course; employees engaged in training range literally from sweepers to scientists.

With the everincreasing complexity of industrial processes, our first line of defense against unemployment must lie in the continuing upgrading of skills throughout the labor force.

Also fundamental is the importance of education to the rising generation—making sure that those now entering high school have the incentive and the opportunity to equip themselves for fruitful employment in the coming years. Here we need to encourage efforts to develop within the school systems an understanding of the contribution of technology and the real significance of automation, as well as a sense of the importance of education and training. Helping to discourage dropouts is an especially important aspect of this problem, and industry has been trying to make a contribution here.

We must remember, of course, that education and job training is only the first step—unless jobs are created, through business growth, training goes for naught.

These twin steps of promoting sustained growth and accelerating education and training are mutually reinforcing goals. The most effective training and upgrading of employee skills occur during periods of rapid economic growth. The questions of "training in which skills" and "will jobs be available" then can be well answered by employers who will be providing the jobs.

The combination of economic growth and advancing work force skills are the essential steps toward a fuller realization of the positive values of automation.

Importance of Sustaining and Strengthening U.S. Economic Performance

Perhaps it might be well to close this discussion with a note on the critical importance of achieving a balanced understanding of automation and positive public policies towards it.

Earlier we discussed some of the contributions toward economic progress which automation promotes. Here we should further point out that a lot more is riding on U.S. economic health now than just the material well-being of the American people. The stability and security of the whole non-Communist world rest on several important pillars, but clearly one is the economic strength of this country.

In our nuclear age, all-out war has become a nightmare no rational power can risk invoking; so ideological conflict must seek other means—infiltration, propaganda, sometimes limited war, economic aid and trade, even the rivalry of the space race. In such a long-term lower-level conflict, economic performance plays a far more important role than in any hot war. This has been true since the Truman Doctrine was enunciated. President Johnson's offer of large-scale economic aid to North Vietnam was a striking indication. In the past we sought to "make the world safe for democracy" through brute military power; in the era of the cold war—and for the foreseeable future—we rely primarily on America's industrial power.

In such a world, our ability to achieve constructive results from advancing technology and to promote sustained economic growth takes on broad significance. If we should make the wrong moves and weaken the economy, the consequences would be serious indeed.

Another aspect of today's world is the resurgence of industrial strength in other nations, notably the Common Market and Japan.

Jobs in American industry are more vulnerable than ever before to international competition from these sources. As a reflection of the benefits of expanding world trade, this is, on balance, a great benefit to the U.S. economy. But it does necessitate vigilant awareness of the competitive imperatives which international markets now impose. For example, proposals to raise costs as an approach to solving unemployment become completely self-defeating.

The overall challenge which economic progress poses to America—and the spirit in which positive policies must be found—was summed up in the following terms in a February 1965 speech by General Electric vice president Virgil B. Day:

> We in America are on the verge of a new economic and social era. Our government has declared war on poverty and unemployment. . . . We are seeking ways to absorb a new wave of youngsters into the work force and they are arriving on the economic scene faster than new jobs are being created. . . . We are worried about avoiding inflation, improving our gold flow position in international markets. . . . And we are all keenly aware that a new era of international competition is making the world smaller and harder to survive in if you are inefficient. . . . We are trying to solve our civil rights and equal employment problems, not only by ending discrimination but by finding new jobs for those previously deprived.
>
> The agenda is almost endless, but I suspect that you will agree that most of the solutions depend heavily on the ability of the whole economy to grow, to prosper, and thereby to provide good and numerous jobs.
>
> Unemployment can represent one of the most searing human problems people face in modern life. Solving this problem of those who face the future without a job demands not only the humane concern, but also the clearest thinking of all of us—employers, unions, government, academic students of the problem, people of good will everywhere. In this area, let us remember there is no necessary conflict between hard-headedness in promoting job opportunities and soft-heartedness in concern for our fellow man. We must achieve results, in terms of more and better jobs, on a firm basis. In the end, the man whose compassion counts most is the one who produces meaningful results.

APPENDIX

Job Displacement in America's Industrial History: A Brief Perspective

Concern over the ability of the economy to absorb labor displaced by technological change is understandable; but it may be instructive (and reassuring) to look at what has taken place in the past.

U.S. history reveals how important and necessary both the growth and displacement effects were in making this the world's wealthiest nation. At the birth of this country, about 90 percent of the gainfully employed were in agriculture and all of their efforts were necessary to feed and clothe the Nation. Today, less than 8 percent of the work force—and a work force with fewer children—are on farms, and we have the agricultural surplus problem. To be sure, there were displacements and "silent firings" (of people who may have hoped for farm jobs). It is clear, however, that if there were no displacement effect to make labor and other resources available for the growth of other industries, we would today be a poor, backward nation—if we survived at all.

Thus, displacement, associated with growth, is a source of economic progress, not of unemployment.

The fundamental differences between the advanced, high standard of living nations and the underdeveloped, emerging countries center around the conditions that make it possible for technological change and automation to deliver their benefits. Advance beyond the state of bare subsistence requires that labor, capital, and other resources be available for reallocation to new industries. If agriculture or the several major types of manufacturing or transportation, or any of the other basic industries never experienced the quality and productivity improvements that automation makes possible, it would be impossible to have the new products and new industries that give us our broadly based standard of living and variety of jobs. For example, it has been stated that it would require all, if not more than all, of the female members of the population to handle the current volume of telephone calls if automatic telephone equipment did not exist.

The industrial diversification and job shifts which have occurred in the dynamic American economy from 1870 to 1960 are shown in figure 12. Over this period the work force increased more than fivefold, from 12.8 million to 68.9 million. Along with this tremendous employment growth, very dramatic changes in the kinds of work occurred. After the Civil War over half of the employment was in industries which extract their products from the earth. Today the combination of agriculture, mining, forestry, and fishing account for slightly less than 10 percent of the jobs. While the fabricating industries (manufacturing and construction) have expanded steadily, the specialization aiding, personal service, and life enriching industries have grown proportionately more rapidly. The three last categories include such industries as radio, television, public utilities, transportation, communication, beauty shops, medical and health services, education, entertainment, and travel. To have an evergrowing diversity of new products and services, continuous change must occur in work force occupations and skills.

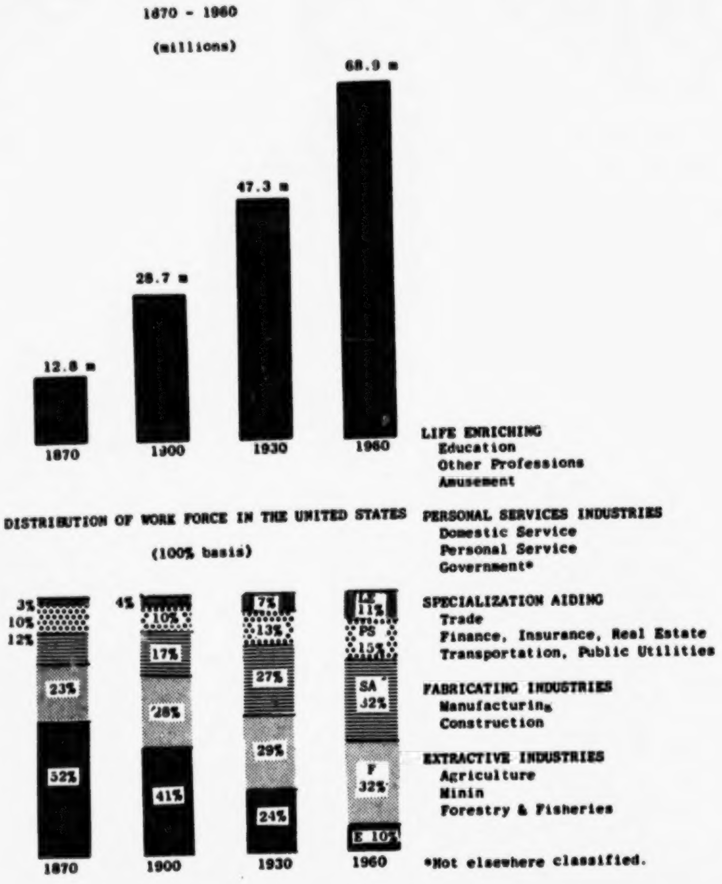

Figure 12.—Growth of work force in the United States.

Source: Yale Brozen, "Automation: The Impact of Technological Change," American Enterprise Institute for Public Policy Research, p. 28 table II, revised.

Our history shows that job displacement and a labor force swelled by large-scale immigration and a generally high birth rate have been matched by the growth of jobs throughout our history. Indeed, economic historians have noted that except during severe recessions or depressions, we have always had some shortage of at least one type of skilled labor or another.

Thus, America's industrial trends reflect how automation or technological change has brought two broad types of benefits to our populace. As consumers, we have enjoyed an everwidening variety and choice of goods and services. As producers or workers, most jobs have transformed from menial, backbreaking, and dangerous chores to more interesting, higher skilled, and higher paying activities.

Job displacement does indeed take place as a result of technological change—but in combination with economic growth, such displacement becomes not a curse, but an indispensible means to progress for the entire economy and for the creation of more jobs.

STATEMENT

Prepared for the Commission
by the
General Foods Corporation
White Plains, New York

Statement by the General Foods Corporation

In 1960 the company attempted to analyze job displacements that might result because of automation and technological changes anticipated in the succeeding 5 years. Technical, engineering, and plant management people were involved in the study. The job displacement forecasts, as a result of the study, just have not occurred. For example:

> At the company's largest coffee operation, there were 1,020 regular hourly employees as of October 31, 1959. Analysis at that time indicated that the work force would be reduced over the 5 succeeding years by 210 people. During those 5 years, extensive automated changes were installed. However, employment, as of January 1965, at that unit was 1,063, or an increase of 43 people over October 1959.
>
> At the company's largest cereal plant, employment for the year ending January 3, 1960, was 1,622. Judgment at that time indicated that during the next 5 years as many as 200 jobs would be eliminated. However, as of January 1965, there were 1,683 regular employees working, or an increase of 61 people. In this particular instance, technical changes were introduced in the manufacturing process; but at the same time technological application in product development resulted in new products which created additional jobs, offsetting loss of others as a result of automated process changes.

These are only two examples, but they are quite typical of employee experiences at our other manufacturing facilities. Like most other large food companies, we have been applying technical know-how in the areas of automation, product development, and other areas of the business for many years. Its effect on employees within our company has tended to increase rather than diminish the total number of job opportunities. In looking ahead to the next 5 or 10 years, we would expect that the application of technology in the development of new and improved products which in turn provide new job opportunities will more than offset the loss of job opportunities due to the application of automated processes.

We believe we have a very definite responsibility to the Nation's economy, to our employees, stockholders, and consumers in our application of technology, automation, and changing methods. One example of this recognition of responsibility can be illustrated in the following experience. Three years ago it was decided to close four outmoded manufacturing operations —two in Massachusetts, one in New Jersey, and one in New York—and to consolidate the manufacturing operations into a single, new, modern facility in Delaware. In the interest of protecting the employees at these locations, everyone was given the opportunity to move to the new location at the company's expense. The company provided every employee and his family the opportunity to visit the new location before making a final decision. It, in effect, was meeting its responsibilities to facilitate occupational adjustment and geographical mobility of employees that were affected. The company worked closely with the unions who were involved at the four plants in working out the orderly transition to the new location.

As of today, the total employment at this new large facility is approximately 1,700. Fifty employees are still working at one of the locations yet to be completely closed and 40 at another, giving a total of 1,790 as against a total employment of about 1,890 at the four locations that were or are being closed. Out of that total, 440 elected to transfer to the new location. Termination pay was granted to those who elected not to move as well as aiding the employees in finding new employment. The original estimate was for about 1,200 employees at the new facility, but the application of technology in product development created new jobs. Thus it is expected the total employment at the new location will ultimately exceed that of the original four locations.

This experience has contributed—and should in the future contribute—to the national economy, provide better products for consumers, and result in greater efficiency and productivity which will benefit our stockholders.

To sum up—the application of automation would by itself result in reductions in manpower requirements. However, in our company, the development of new products, processes, and other technical innovations have more than offset these manpower reductions. We believe that this would be true for a very wide spectrum of industry where business goals are to provide new and better products and services to the public.

STATEMENT

Prepared for the Commission
by the
General Telephone and Electronics Corporation
New York, New York

Statement by the General Telephone and Electronics Corporation

The Impact of Automation upon the Communications and Electronics Industry

U.S. Economy Has Undergone Large-Scale Revolution

During the past 20 years, the American economy has gone through a remarkable revolution. This has been characterized by enormous expansion, the steady rise in our standard of living, the unprecedented growth of existing industries and the development of entirely new ones, major changes in our markets, greatly increased emphasis on research, and the development of new products and services—all of these having been, in effect, a large-scale revolution because of their magnitude, their impact upon all of us, and the speed with which they occurred. Paralleling this economic revolution in the United States, we have witnessed—and have played a major role in—the economic rebirth of countries devastated by the war. This economic rebirth has brought the emergence of an entirely new phenomenon in world history—a world market with every potential that term implies.

We are starting a new decade in which all of this country's businessmen will be faced with more opportunities and more challenges than ever before in our history. We have the choice of participating in the growth and development of the new and broader markets opening up throughout the free world, and continuing to be the leading factor in the world economy, or we can miss this opportunity and gradually be outdistanced by our competitors. This not only is a new situation for American businessmen—it is also a new situation for all Americans—because the great advances in communications, in the ability of the people of the world to maintain effective contact with one another, have combined to reduce remarkably the obstacles of time and distance which in years past have inhibited the expansion of world trade. The trade horizons of every country have greatly broadened, and businessmen throughout the world are seeing opportunities for increased trade that they never saw before.

Moreover, this economic revolution throughout the world is far more than a trend which need concern only large industries. It is profoundly affecting every industry and every business. In its relative way, the small business in a small town is just as deeply involved as the country's major corporations.

Every business enterprise, large or small, is faced with a whole new set of opportunities and challenges.

Opportunities and Challenges

Let us examine four major opportunities and challenges.

1. We must place greatly increased emphasis on innovation and invention. Aside from constantly improving our existing goods and services and producing them at competitive costs, we have the even greater challenge of developing entirely new products and services, new ways of making them, and new ways of getting them to customers here in the United States and throughout the free world.
2. We must assure further automation and mechanization of both our manufacturing and our administrative processes so that we can attain the higher volume, lower costs, greater flexibility, and higher efficiencies which we will need to compete in the marketplaces of the free world.
3. We must be more effective managers and develop new managerial skills. We must do a better job of organizing, of instilling in our management people that dynamic point of view that makes things happen, that encourages teamwork, that encourages the delegation and acceptance of responsibility.
4. We must adapt our entire distributive process more effectively to our existing and potential markets. Worldwide markets require a worldwide viewpoint, and that will mean changing some ideas and practices we have had for years.

All four of these challenges really add up to one overriding challenge—and that is the necessity for devoting greatly increased attention to finding entirely new and better ways of doing things. This is symbolized so effectively by the need for further automation and mechanization as a means of meeting the steadily increasing demand for new and improved products and services.

Automation and Industrial Growth and Development

In approaching mechanization or automation from the standpoint of its influences on the growth and development of specific major industries, let us consider the communications and electronics industries.

Growth of Communications Industry. The growth and development of the communications industry—with estimated revenues this year of $13 billion, or more than double the total of 10 years ago—is one of the most impressive examples of automation in the history of this country. I am referring, of course, to the automation of the nation's telephone systems. This has been a large-scale revolution, and without it, this country could never have attained the quality, quantity, and breadth of telephone service all of us enjoy today. More specifically, there are not enough women and girls of working age in the entire country to do the job of manually switching telephone calls.

Enormous Amounts of Capital Required. Needless to say, automation in the telephone industry has required enormous amounts of capital. The General System today serves nearly 7 million telephones (of which 6,300,000 are in the United States, constituting the Nation's largest independent telephone system), and nearly 99 percent of these telephones are dial-operated. Attaining this degree of automation has required the investment of enormous amounts of capital. In the past 5 years alone, we invested more than $1.6 billion in new plant and equipment. This year we are investing a new record total of more than $450 million, and over the next 5 years an estimated $2 billion will be invested in new facilities. Another way of describing the investment required in the telephone business is to point out that our average investment per telephone is about $460. In 1955, the comparable figure was $267, which reflects a 70 percent increase in 10 years. However, an average figure does not tell the complete story because the investment represented by each new telephone today is far greater due to steadily rising costs.

The steady expansion of automation of telephone service in our operating areas has been accompanied by increased, instead of reduced, employment opportunities. In General Telephone of California, for example, there were some 716,000 telephones and 7,200 employees in 1955. Today, there are more than 1,600,000 telephones and nearly 15,000 employees. In General Telephone of Florida, the number of telephones has increased from about 260,000 in 1955 to more than 550,000 today, and employment has grown from 2,500 to nearly 5,000. On a systemwide basis (which includes telephone operations in portions of 33 States as well as British Columbia and the Dominican Republic), the 7 million telephones we serve today are in contrast to about 3 million in 1955. Employment in these telephone operations exceeds 59,000, against 32,000 5 years ago, although the percentage of dial (i.e., automatic) telephones increased during the same period from about 80 percent of the 3 million telephones in 1955 to nearly 99 percent of the 7 million in the General System today.

Taking the General System as a whole (including the manufacturing as well as the telephone operating companies), employment has increased from 71,000 in 1955 to more than 117,000 today. Wages, salaries, and benefits increased from $270 million paid in 1955 to more than $600 million in 1964—an increase of more than 120 percent. This reflected not only a greater total number of jobs but broader employment opportunities and higher pay. Without large-scale automation, growth of this magnitude throughout our operations could not have occurred, because automation was the key to providing new and improved services and products to meet the growing needs of our customers.

Rapid Expansion of Electronics Industry. This year, total sales of the electronics industry should exceed $17 billion, or double the total of only 5 years ago. The growth and development of this relatively new major industry is closely allied with automation and mechanization. Consider these facts:

1. Without the large-scale use of automatic and semiautomatic equipment, the electronics industry, as we know it today, would not exist.
2. Without extensive mechanization, the electronics industry could not even remotely produce the vast volume and variety of goods needed and demanded today by the public, commerce and industry, and the Armed Forces. Mechanization has been the key to greater production volume, lower costs, higher product quality, greater uniformity, and improved product performance. In effect, mechanization has

actually met what would otherwise have been a long-term labor shortage.

3. The increased demand for, and availability of, the products of the electronics industry has brought a great expansion of the basic materials industries which furnish raw materials and certain components, such as metals, glass, chemicals, and plastics.

4. Thousands upon thousands of small businesses have been formed over the past few years, especially the postwar years, to provide components, materials, supplies, and services for electronics manufacturers.

5. Hundreds of communities have gained new economic strength, either through the expansion of an existing facility or the construction of a new plant or laboratory facility.

6. An enormous new business has sprung up, completely outside the electronics manufacturing business. This is the electronics distribution and service industry—distributors, jobbers, dealers, servicemen—a business that did not exist a few years ago and which has multiplied manyfold since the war.

These are the ramifications of mechanization. It is not a case of putting a machine to work in one plant, or two plants. It is a case of creating an entire set of industries, hundreds of thousands of jobs that did not exist, millions of dollars of personal income, of buying power, and new lifeblood for the entire economy.

Administrative Automation—Electronic Data Processing. Aside from the automation and mechanization of manufacturing processes, administrative automation—electronic data processing—is opening up new concepts in business management.

The parents of electronic data processing are complexity and competition. Every aspect of business is far more complex than it was 10 or 15 years ago, and this is true of our entire economy. Much of this is due, of course, to the unprecedented growth and development of technology, particularly in the past 10 years. Today, science has so many facets that it is extremely difficult to measure the potentials in a few of the major fields, let alone grasp the overall picture.

In addition to the increasing complexity brought by the expansion of technology, the emphasis is on speed and more speed. To stay in the competitive race, operating information must be made available at a speed and in a variety that has never been available before. The problem of compiling, transmitting, and processing operating data—such as payrolls, production volume, costs, inventories, shipments, and so on—has become increasingly difficult and increasingly costly. There is less and less time between events in this dynamic economy of 1965, and because management must base its decisions on those events, all levels of management require more complete and essential information faster than ever before. But, even more importantly, new types of information, new tools for management, are required.

More than ever before, and particularly in today's intensely competitive economy, management needs information in time to do something about it. Where we were yesterday is significant up to a point, but the real payoff comes in knowing what is happening right now, so that you can better control what will happen tomorrow.

As our economy keeps on growing, there will be an everincreasing premium on putting machines to work throughout the office to meet the growing demands of the entire economy. Man and present-day machines and methods could never begin to do all the administrative work that will be required of him in the years ahead. Greatly increased use of machines is the only way we will be able to develop procedures to handle the administrative loan of the future.

STATEMENT

Prepared for the Commission
by
Honeywell, Inc.
Minneapolis, Minnesota

Statement by Honeywell, Inc.

Honeywell makes a highly technical product line. One in five of every employee on our payrolls is engaged in technical activities, and about one in eight of all of our employees is a professional engineer or scientist. Without technological change, there would be no Honeywell. Over the past 75 years, we have continued in business and have enjoyed a very rapid growth for one reason and one alone—the development of automatic means of doing what previously either had been done by hand or was not capable of being performed at all. We have, therefore, lived and prospered under conditions of continuing and accelerating change. Our more than 50,000 employees have jobs as a direct result of automation. We believe our future to be an attractive one. Through expected future change and technological advance, we anticipate even greater opportunities than any we have had in the past. We therefore welcome, and try to make our very best contribution to, technology, automation, and economic progress.

Over the years, we have steadily experienced the impact of technological and economic change on our production and our employment. The very nature of our business—originally automatic control devices, and more recently automatic electronic systems—has regularly crowded the technical state of the art. Each year, we seek to employ outstanding individuals from the graduating classes in science and engineering, and the proportion of scientific and engineering personnel in our organization has steadily increased. Because we create, live with, and make a successful business of change, the prospect of shifting job requirements holds no fears for us. We accept too the continuing need for higher and higher levels of education in our employee group and that we must adapt to the increasing magnitude of economic ups and downs, as the size of the projects we are capable of managing increases. We believe nevertheless that our stability of employment and the long-run career opportunities we shall be able to offer may be better than the average. In fact, it is our observation that job security, rate of pay increases, and promotional opportunities are poorest in those industries and those companies which have not made full advantage of the increasing pace of technological change nor made adequate forecasts or adjustments to the ups and downs of economic activity. The same is true of individual employees. Those who see opportunity in change and who regularly make the effort to keep themselves up-to-date enjoy the steadiest employment, make the steadiest economic progress, and are most often selected for promotional opportunity. It is the employee who resists change, who tries to stretch out or "share" work, or who when confronted with loss of work as a result of an economic downturn sits and waits, preferring unemployment compensation or welfare to retraining or relocation, who tends to drift first into the hard core of the unemployed, and finally, into the ranks of the unemployable.

It is our opinion that wage and salary rates will continue to rise, that the economies of other countries will continue to strengthen, and that technical progress will continue to accelerate. The net effect of these three will be, first, to make economically feasible and desirable a steady transfer of more physical and more routine mental tasks from people to machines. Second, other countries will become increasingly competitive with us on the less sophisticated product lines. Third, our opportunity for continued economic growth and a rising standard of living will be more and more limited to our successful accomplishment of the most advanced and difficult products and services. If we accept this challenge and organize to meet it, there is no reason why we should not be able to stay out front competitively with the rest of the world. If we resist it, however, by deliberately failing to take full advantage of technology and automation, the price of doing so will be acceptance of slower economic progress and a static or falling standard of living. In other words, we either afford ourselves a successful result by concentrating on that share of the world's activities at which we are clearly most advantaged or we reduce ourselves to competing with the rest of the world on products and at an economic level where they now have the advantage over us.

Specifically, one of our most challenging tasks is educational. The public needs to know, for example, that an economically successful education, whether professional or vocational, is not likely in this country in the future to be obtainable in the prework years alone. No longer will people be likely to learn a trade that will last unaltered for a full worklife. Our formal educational requirement, whether professional or vocational, will be to learn how to study and how to learn. The formal education will simply be the foundation on which to build the continued learning that will be necessary to be an active and successful participant in our future economy. It is likely that in the future, multiple jobs rather than a single job will be the lot of most of us. Even within a given job title, whether it is toolmaker, electronic technician, design engineer, or business manager, the job will undoubtedly change so fast and so drastically over the period of a single worklife that repeated and almost continual learning will be required for a person to stay successful in that one job. The reason for this is easy to see. If our chance to continue our economic growth and to increase our standard of living requires staying ahead of the rest of the world, we must have a more flexible, more mobile, more up-to-date work force than our competitors are able to maintain.

The impact on employment of the changes we see will be to steadily reduce the number of people actually required in the production of a given quantity of goods but to increase greatly the number required in the production of services. For example, if some economically and socially acceptable way of providing personal service could be found, it might be of great help. There is now probably a great unfilled demand for all sorts of such services. The demand remains unfilled, however, because the way such work has been organized in the past has resulted in making the performance of it unattractive and socially unacceptable. If the key to meeting this need can be found, we should be on the threshold of a dramatic employment expansion.

Another example is the need to improve understanding of the effect of increasing international competition. If labor costs rise as fast or faster than productivity, our fixed or rising price level will tend to reduce our growth rate and threaten our standard of living by making foreign goods better able to compete with ours, not only in other markets but in the U.S. market. Only as labor and other costs fall, so that prices fall, shall we be able to grow and assure a steadily rising standard of living. This has an important impact on pay levels, too. If pay levels rise too fast relative to productivity, the only way to keep labor costs from rising too fast is to accelerate automation. This results in more employment displacement than would otherwise be necessary. By keeping pay level increases moving at a reasonable rate, automation progresses in more orderly fashion and displaced personnel can be more readily retrained and relocated, minimizing unemployment.

From a careful consideration and evaluation of our experience and of the economic and social trends we see, it is our opinion that the best way for the U.S. Government to assure future growth and success is to encourage our private capital, free enterprise economy by (1) withdrawing from direct competition with private business, (2) reestablishing a fair, impartial application of the laws applicable to business, especially as applied by the departments and the administrative agencies, and (3) making greater use of competition and less use of detailed government regulation, to encourage economic growth.

STATEMENT

Prepared for the Commission
by
Inland Steel Company
Chicago, Illinois

Statement by Inland Steel Company

Some months ago the chairman of the board of our company, Mr. Joseph L. Block, who is a member of the President's Advisory Committee on Labor Management Policy, submitted a statement on technology and automation to the Secretary of Commerce calling attention to the committee's paper, "The Benefits and Problems Incident to Automation and Other Techonological Advances" which was submitted to the President on January 11, 1962.

We believe that the Commission's attention should be called to two key statements in this report. The first is:

> We emphasize the imperative need for desirability of automation and technological change. Indeed, increased productivity and fuller utilization of resources are urgently needed to improve our rate of economic growth. They are likewise needed to improve our competitive position in world markets. Failure to advance technologically and to otherwise increase the productivity of our economy would bring on much more serious unemployment and related social problems than any we now face.

While this might seem clear to knowledgeable individuals, we believe there are many people in the country, some of them in high positions in the academic world or in labor, who do not believe this is a true statement of fact. It seems to me that the Commission could serve a very important function by documenting pertinent information and giving it wide publicity so that all responsible leadership in the country will be fully convinced of the importance and necessity of fostering technological progress. There is no question about the fact that much of the outstanding industrial progress made in the United States has been due to the fact that our people have had complete freedom to develop their own ideas without governmental intervention and restriction.

The second statement from the report that we wish to call to the Commission's attention is:

> The achievement of maximum technological development with adequate safeguards against economic injury to individuals depends upon a combination of private and governmental action, consonant with the principles of the free society.

This, in our opinion, is the greatest challenge the Commission faces. Indeed an invaluable contribution to the welfare of the country would be made if the following recommendations were developed:

(1) Techniques for estimating future skills needed in the economy by category and on a quantitative and time basis.

(2) Methods for providing schools and colleges with this information so that their curriculums can provide training for these skills.

(3) The development of public programs to provide training for such skills for displaced persons who cannot be given adequate training by their former employers. (The first responsibility for such training should, of course, be by the employers, but for a variety of reasons there are and will continue to be many cases where this cannot be done. Such a void can only be filled by some such type of training program.)

STATEMENT

Prepared for the Commission
by the
International Brotherhood of Pulp, Sulphite, and Paper Mill Workers
Washington, D.C.

Statement by the International Brotherhood of Pulp, Sulphite, and Paper Mill Workers

This international union has been extremely interested in the impact of technology and automation on the national economy and on the economy of the pulp and paper industry. Such interest, basically of course, derives from the union's position as a composite designed to protect the interests of its members. The interest, particularly, also derives from the International's recognition that the interrelated and independent areas of automation and economics presents a new and highly complex aspect to collective bargaining—an aspect which did not exist 15 years ago; an aspect with no precedent for solutions; and, consequently, an aspect requiring considerable original thought.

The union's overall concern is with the impact of automation and technological change on the socioeconomic structure of the United States. Automation, in one sense, is an adjunct to and operates in conjunction with other forces which have acted to alter substantially the basic method by which goods and services are produced and distributed in this country. New demands for new products have resulted in the creation of industries and processes which did not exist 15 to 25 years ago. Some of these new processes were revolutionary, while some were refinements of existing methods. The use of automatic electronic computers in scientific research, on the other hand, represented work which was previously impossible. The use of printed circuits and miniaturization in electronic components amounted to a substitution of existing methods.

These advances were unique and beneficial in themselves; they also produced unique changes in the socioeconomic structure of the United States. As new industries developed around the new processes and products, the industries themselves began to be located in new areas of the country. The population shift to the West Coast and particularly Southern California during and after World War II attests to the labor mobility of the work force of the United States. It evidences the adaptability of people and industry to relocate in different areas of the country. It also implies the subtle relationship between new technology and a changed structural relationship in this country. As previously nonexistent industries developed around new technologies in new areas, the labor force adapted in a like manner.

In the pulp and paper industry one form of technological change was represented by the ability of the sulphate or kraft process in the manufacture of wood pulp. This process was developed in the early part of the 20th century and made possible the use of southern softwoods. This technological innovation led not only to a geographical shift in the production of wood pulp, but also created a new industry in an area where one previously did not exist.

In observance of these phenomena, this international union, as a participant in the social and economic development of the United States, is and has been concerned with the impact of automation and technological change. This holds whether the change took place some years ago, and consequently caused results which exist today, or whether the innovations which are permeating the economic structure of the country now will create permutations in the future.

Technical and Economic Aspects in Relation to Pulp and Paper Industry

This International's concern with the impact of automation and technological change derives, essentially, from its existence as a trade union functioning as a force in perpetuation of the interests of its membership. In light of the impact of automation on the working force of this country, and especially of the impact upon the members of this union and the members of the AFL-CIO, interest and concern is vital and important.

While the relation between the introduction of automation and technological change and declining production worker jobs is difficult to determine, the relationship is nonetheless omipresent and is to be seriously considered.

In one sense the status of production worker employment in the pulp and paper industry is fortunate in that the total number has risen over the past decade. Production worker employment in the pulp and paper industry rose on the whole, for example, between 1953 and 1963 by about 10 percent: the number of similar employees in all manufacturing industries during the same period actually declined by more than 10 percent.

This comparison, when taken by itself, would appear to be a favorable indicator. During a period of public and professional concern with the impact of automation on production worker employment, the pulp and paper industry reflected increases while all manufacturing industries showed a decline. When other significant factors are considered, though, the resulting opinion tends to be somewhat different. Or, the basic outlook of the union tends to require prescient thinking on the topic.

Initially, output of paper and allied products has been increasing, and at a faster rate than for all manufacturing industries. Between 1953 and 1963 the Federal Reserve Index of Industrial Production for paper and allied products rose to 125.1 from 81.1; the index for production turned out by all manufacturing industries increased by about 10 points less, to 124.9 from 92.7.

The relation between the two above-mentioned increases, output per production worker manhour, concurrently has maintained approximately the same upward trend. Between 1953 and 1962, the latest year available (Bureau of Labor Statistics), productivity in pulp mills and paper and paperboard plants increased by 40.4 points, to 121.7 from 81.3.

The basic concern with the impact of automation in the pulp and paper industry, however, is to be found in its potential liability. Although production worker employment has been increasing and productivity increases have not, at least yet, caused any declines, the possibility of detrimental effects within the near-term future are distinct. This is based on observation of certain pertinent trends within the industry and which have a direct bearing on the situation. A combination of certain interdependent occurrences which produce a cumulative effect on employment—some directly concerned with automation and technological change and some indirectly—are, all of them, detrimental.

The extent to which automation produces an impact on production workers in a given industry depends, in the first place, on the current manufacturing process in the industry and the rate and type of technological innovation. If, for example, the manufacturing process requires large amounts of labor the introduction of one or a series of labor-displacing automated equipment will produce a heavy impact on the employment of workers in that industry. On the other hand, if the manufacturing process currently involves more equipment than labor, the rapid introduction of automated equipment will not produce an immediate and heavy impact.

The oil refining industry since its beginning, for example, has involved the use of a flow-process of production which does not require large amounts of labor relative to some other industries. The value added to oil, in other words, during its processing from crude to refined represents relatively more use of the cracking process than labor costs.

The metalworking industries represent an example at the other end of the scale. Until very recently, the value added by manufacture of a finished metal product largely represented the skill of the machinist in using a lathe, drill press, and so on in the conversion of the original piece of metal into the finished product.

In the first instance, oil refining, the introduction of automated equipment would tend to produce relatively less drastic manpower effects than in the metalworking industries. The basic method of refining crude oil could be altered by the introduction of more refined control instruments in the cracking process. This would not tend to produce relatively drastic manpower requirement reductions. The introduction of numerically controlled machine tools (those which operate almost automatically) would tend to replace the human function in metal operations. Thus, the basic result of the technological innovation first has to be viewed in relation to the manufacturing process and manpower requirements which it will produce.

Mass production of pulp and paper, almost since inception, has fallen somewhat in between the above-mentioned extremes. To a certain extent, the manufacture of pulp and paper is a flow process, where a flow process generally requires relatively less labor output. In another sense pulp and paper manufacture requires a certain amount of labor input at various parts of the manufacturing process.

A brief description of the basic pulp and paper production process with the attendant labor requirements will exemplify this. After the logs have been forested, they must be barked and chipped. Sawyers are required to cut the logs; barkers operated barking machines; and, chippers operate chipping machines. Thus, although there is a flow process similar to that used in oil refining, an equipment operator is necessary at each of the three junctions.

The chips are then put into a digester vat, cooking liquors are added, and the chips are digested or transformed into a pulp state. The necessary pulp fibers are then moved to the paper machine. The digesting part of the process requires a digester cook, assistants, and other employees to separate the pulp fibers from the unnecessary lignin.

As the pulp is moved onto the paper machine in a highly liquid form, large amounts of the water are removed by a draining method. As the cellulosic fibers are drained the paper begins to form. A paper machine operator and helpers operate the machine. The end of this continuous process occurs when the dried paper is taken from the rollers and put on rolls or are further processed.

The basic method has been in use since the beginning of mass production of paper. Obviously some degree of or combination of mechanization and labor requirements has been maintained at a relatively constant pace. This, in effect, would obviate any drastic or sudden manpower requirement changes such as could occur in the metalworking industries. Nor would it, on the other extreme, be as subject to a complete flow process as the oil refining industry. However though pulp and paper manufacture may lie in the middle ground of liability to sudden technological innovations, the possibility of gradual intrusion remains. It is largely to this possibility that the concern of the International towards its members is directed. Or, automation and technological change does not, contrary to the popular view, have to occur in one fell to create manpower difficulties.

In the pulp and paper industry the rate of technological innovation has been increasing steadily since the end of World War II and has occurred as changes in existing methods rather than complete alterations. As a Labor Department study of the industry relates, "A significant postwar trend has been the linking together of separate production steps and elimination of labor involved in direct production. This trend is particularly important in wood handling, pulping, and shipping operations."

This same report, continuing a description of mechanization of wood handling operations which "require extensive manual effort," said, "Some pulp mills have developed unique side-dumping rail cars and other mobile devices which either rake or shove pulpwood off cars and into conveyors of flumes. These changes greatly reduce the need for manual labor."

Other types of technological innovation being introduced into the productive method of the pulp and paper industry take the form of more intense levels of instrumentation. The magnetic flowmeter, first introduced in 1955, is used to measure and control the flow of pulp through refining equipment. Radioisotope gages are used on paper machines to measure and control the basic weight of paper and paperboard, and thickness of coated, laminated, and impregnated paper products.

A significant technological change within the industry is the adoption of continuous digesters. Historically pulp has been made, or digested, by batch methods in a cooking or digesting unit. This requires specific inputs of materials, cooking controlled by a digester cook, and release of the cooked pulp, one batch after another.

A continuous digester performs this operation as a continuous stream, producing a flow of pulp, thus eliminating a step-by-step procedure. And further, the new continuous digesters are equipped with automatic sensing devices which eliminate much of the need for human observation. Obviously, these innovations have manpower effects—negatively. Too, they are slow, almost imperceptible, and devastating.

Social Impact

The social effects of the impact of automation throughout the country are many and diverse and have been discussed many times before. The social effect of the impact of automation in the pulp and paper industry take form, in at least one respect, as a result of the geographical location of the industry.

It has been true in the past, and holds true now, that the basic pulp and paper industry has been located in relatively small- or medium-size communities. In many instances a pulp mill and adjacent paper plant have been the dominant employers in the community. Taking into account the fact that the pulp and paper industry has had one of the lowest labor turnover rates of any manufacturing industry, the effect on the community, and consequently the social aspect of the community, of a permanent reduction (for permanent reductions are most common results of automation) in a local work force as the result of automation would be one of significant disruption.

Future Impact on the Pulp and Paper Industry

The economic effects of automation in the pulp and paper industry can be evaluated on what has occurred in the past and what can be expected in the future. These results are viewed not narrowly from the perspective of automation itself, but from a number of other factors which bear on the subject, with automation and technological innovation as the focal point.

Above all, the union does not view automation as a maleficent force tending always to destroy jobs. In some instances this may be the case; in others, a technological innovation may tend to create new jobs through the manufacture of new products.

One such job-creating, technological innovation occurred recently in the pulp and paper industry. In the conversion of wood to pulp, two major byproducts result. One of these is the pulp used in the manufacture of paper. The other is a substance called lignin. Lignin has been mostly a waste byproduct and consequently has been a major source of mill effluent.

Research directed toward useful development of lignin produced a new substance known as DMSO, dimethyl sulfoxide. DMSO has been used as solvent and as a reaction medium in industrial processes. Lately it has received attention as a possible "wonder drug" for the treatment of bursitis and other arthritic conditions. Medical studies, more recently, indicate DMSO's other medicinal properties, including the ability to penetrate the human skin, an unusual ability.

At least one large pulp and paper company currently is producing DMSO from the byproducts of its pulp manufacturing process. Clearly, the immediate employment effect of such a plant would be to create additional job opportunities.

I.B.P.S.&P.M.V. Activity

The economic effects of automation upon employment result from the technological changes, part of which have been discussed previously. The loss, permanent or temporary, of jobs represents the most significant economic impact of automation. This impact, this International strongly feels, has not and will not occur in one significant time or place. Instead, the declines will take the form of a steady but perceptible deterioration. One of the strongest forms of job protection from this type of encroachment is the inclusion into the contract itself of language which, if not mitigating, prohibits layoffs to the greatest possible extent.

The International's activity in this area has been based on a broad dissemination of knowledge of automation. Basically, the union predicates this approach on the idea that, of the great morass of information which has been collected, processed, and published on the topic of automation, most of the output has been directed towards the academic and professional levels and some general but brief output for the lay public. Very little of this information has reached the people who are affected the most by industrial automation—the production workers themselves—and these are the same people who negotiate and sign the collective bargaining agreements under which they work. This lack, the union feels, can prove to be a great pitfall to the local union members. For without knowledge of that which they are dealing, the end result—the signed agreement—is not very effective.

The union's efforts, consequently, have been directed towards informing the membership of the potential liability of automation and suggesting remedies which can be applied before any detrimental effects take place.

The International's initial effort in this direction came at the 1963 meeting of the executive board. At that meeting the department of research and education was directed to prepare an extensive report dealing with automation and collective bargaining.

The first edition of *Automation: Economic Implications and Impact Upon Collective Bargaining* was published in early 1964. A second, revised edition was published later in the same year. This 450-page work encompassed virtually the entire field of automation, both technically and economically, and especially bore on the relations between the economic implications of automation and the state, both present and future, of collective bargaining. The book, in keeping with the basic objective of the union, was distributed to the international staff and to each local union.

This study, in essence, provided the keystone for the union's basic position regarding automation; both in the socioeconomic sense as automation affects the United States and as automation affects the membership now and in the future. This report also provided the base from which was to follow more positive and direct action on the part of local union collective bargaining.

Suggestions

The publication of this book and the succeeding dissemination of information also provides the link between the union's efforts in the field and section (e) of the Commission's mandate, which is most specifically related to the chasm which exists in contemporary collective bargaining.

The problem is not one of simple and precise definition, but rather is complex and tangential to many other issues. For example, more than commonly held is the fear of mass displacement by one, all-consuming machine. Automation by itself may be a slow, eroding process. Or, technological change may result in decreased demand for one type of input, the results of which will affect workers in the initial industry. The problems of automation and technological change, though, also relate to the changing intrastructure of the American economy. It is common, for example, for unions to bargain nationally with large corporations which have many plants widely spread throughout the country. It would not be an uncommon occurence for a company to want to close one of its older plants and build a replacement. The results of this on the work force of the plant involved would depend then on many of the company's decisions, such as new machinery, location, and so on. Obviously a new plant would logically be designed to accommodate the newest, most technically refined production equipment available. The extent to which the operation of such equipment varies from the existing skills required for the replaced equipment would be in almost direct proportion to the skills which exist in the work force. A less direct but as meaningful problem would develop if the company decided to build the replacement facility in a completely new geographic location. This would create many disrupting problems for the work force in question.

The problems outlined above are just some of the more obvious situations which arise when automation is considered; there are any number of other problems which also arise. Until now the common ground for settling these problems has been the collective bargaining process, and the collective bargaining agreement. Management has relied heavily on its prerogatives to conduct the business as efficiently as possible. Labor has relied on its inherent objective of job protection. Both sides of course are right. Most of the attempted immediate solutions, such as consultation, retraining, and so on, have appeared as relatively short paragraphs in the collective bargaining agreement. (This excludes some outstanding attempts, such as the Kaiser Plan.) Other innovations have also appeared, such as supplemental unemployment benefit plans and early retirement, which are really solutions after the fact of disruption or displacement.

Thus, the two most common methods of approach have been short, specific paragraphs in agreements and ex post facto grants to eliminated workers. These approaches are well-intentioned and have helped—they are fetal-stage approaches to a widespread and complex situation. The solution of grants-in-aid to eliminated workers should be continued. The method of coping with automation-induced problems though, deserves deeper inspection and considered reform. Or, automation and its attendant problems create a situation with which the present apparatus is not really able to cope.

The basic conflict then arises between the need for simplicity of the agreement itself and the need for dealing with a highly complex problem. Labor-management contracts historically have been kept relatively short and uncomplicated for a number of highly desirable reasons. If the agreement is written in highly legal terms it becomes unintelligible to the membership. If the agreement tries to cover too many topics in too much detail it becomes an inflexible vehicle for carrying out its purpose of maintaining stable relations.

The atmosphere in which the necessary change must take place will have to come primarily from the two principle parties involved, labor and management. Up to now both groups have approached the problem as reactions to infringements on their historically vested rights and prerogatives. Automation has mostly been treated, in other words, as a simple problem with a simple solution. The real solutions will come when both sides convince themselves that each has to take positions which allow for a great deal more latitude in working towards and congealing the many solutions.

This broadened approach will have to encompass the idea that disruptions in the labor force caused by automation are not academic problems to be mulled over by theoreticians but are causes of social and economic problems both locally and nationally. People out of work have less income and consequently do not have ability to create demand for goods. Production and the gross national product consequently suffer.

What is needed is for labor and management to approach problems associated with automation much more freely. Labor would tend to accept considerably more responsibility towards the situation in self interest. Were management, for example, to make known its plans to introduce technological changes well beforehand, unions would be in a much more flexible and agreeable position. Too often most such changes are announced immediately prior to installation and unions must react immediately in self-interest. A two-way approach of establishing some type of communication for a period of 6 to 18 months prior to installation would alleviate many potential and unnecessary tension before they occur.

A new, more flexible attitude towards automation and technological change is certainly needed if for nothing else than to prevent the social and economic disruptions which often occur as the result of their introduction. By comparison, what is gained through rigid stands appears very weak to what could and can be gained by enlightenment.

STATEMENT

Prepared for the Commission
by the
International Chemical Workers Union
Akron, Ohio

Statement by the International Chemical Workers Union

The Federal Government, in cooperation with the various State governments, can provide services to our society over a broad spectrum. The use of *massive training and retraining programs* will help workers increase skills; the proper use of the U.S. Employment Service in describing areas and types of job vacancies will aid both management and worker; while Federal laws providing decent standards of unemployment compensation, subsistence allowances for persons while being trained or retrained, and financial assistance to those who are willing to relocate will aid all segments of society to surmount the unusual problems brought about by an automated society. The basic problems are of such a nature that they require the cooperation of labor, management, and government if they are to be solved. In this respect we can learn much from one of our allies, Sweden, which has done a creditable job in alleviating the suffering brought about by job shifts attributable to technological change. We are hopeful the Commission will not overlook efforts made by other countries, as well. Above all, we hope your recommendations will be such that they may be instituted in this period of high economic growth—that they will be anticipatory in nature rather than defensive and employed only in times of depression or recession.

In this period of rising demand, the chemical industry seems to be in between very highly automated industries which have suffered sizable reductions in employment and industries which are just beginning to automate and have not suffered significant employment reduction. The chemical industry is growing, however slowly, in total employment. Intraindustry shifts, however, present many problems. Those most affected are production workers whose relative position is worsening at a time when production is at its highest.

Since 1947 blue-collar employment increased only 8 percent in the chemical industry while white-collar employment increased 117 percent. In 1947 there were three production workers for each nonproduction worker, while in 1964 there were about one and one-half production workers for each nonproduction worker. The total employment increase for the industry was 35 percent, but production increased by 284 percent over the same period.

To further supplement the argument of a comparatively highly automated industry with a changing work force, the National Industrial Conference Board data on investment reveal that the chemical industry in 1962 invested $43,700 per production worker as opposed to $21,800 for all manufacturing. Only two industries have higher figures—petroleum and tobacco. The petroleum industry, with its $110,700 per production worker investment, actually reduced production worker employment by 32 percent since 1947. Over the same period the number of production workers in tobacco was reduced by 31 percent. The raw figures in both cases show the reduction in the number of production workers was greater than the reduction in total industry employment—in petroleum 54,000 versus 34,000, and in tobacco 34,000 versus 30,000.

We are fearful that the future of the chemical industry will be synonymous with what has happened to petroleum and tobacco. Chemical processes lend themselves to automation and computerization. The industry is planning tremendous capital investment in the next few years, but we wonder about the impact of this increased investment on employment. We believe we should make positive moves now instead of waiting for the awful truth to make crash programs necessary.

The position paper on automation, which follows, was prepared by our research and education department for submission to our First Collective Bargaining Conference, held in Washington, D.C., November 29–December 2, 1965. The paper discussed the broad problems as well as the specific problems which automation has brought to the chemical industry and offers some suggestions for collective bargaining which would help alleviate the impact of technological change on the workers.

Automation: a Position Paper

Introduction

Automation—blessing or a curse: Automation up to this point has not been the blessing that we believe it can be. At the 1963 convention of the AFL–CIO, President George Meany declared that up to that point he would have to declare that automation had been a curse.

Today, even with the highest production rate in the history of our countries [United States and Canada], unemployment still remains too high, and in the United States it has not yet been reduced to the "interim goal" of 4 percent which was the goal finally unofficially accepted by government planners. In Canada, 3.6 percent of the workers remained unemployed in September.

The problems of unemployment cannot be entirely overcome through collective bargaining. Many of the problems can be overcome only through action of all of the people through education and elimination of all forms of job discrimination, and in an adequate unemployment benefits system for as long as a person is unemployed. We must, however, use our collective bargaining processes to alleviate the problems created by technological change insofar as it is possible to do so.

A shorter workweek seems the obvious answer to the problems of unemployment, and the chemical industry basically is able to afford a 35-hour week and a substantial increase in the weekly pay as well. However, we must be realistic enough to accept the fact that we can accomplish the goal of a shorter workweek only along with the rest of the labor movement, undoubtedly accompanied by Government action. Even with the shorter workweek, however, which does not appear possible in the short run, there will still be technological change due to product and process changes, plant closings due to obsolescence and merger, changes in the availability of basic materials and power, and for other reasons.

While accepting automation, with the promise of long-term benefits, we believe that the industry and the company which benefits immediately from the fruits of automation should help pay for the human cost involved.

Automation in the United States and Canadian Economy

In the discussion which follows, the terms "automation" and "productivity increase" are used synonymously because there are simply no data available in either country for measuring the effect of automation as such on the total economy. The justification for this synonymous usage is that automation has greatly increased productivity (output per man-hour), and there have been definite effects from this increase. It is hopeful that in the very near future both the United States and Canada will be able to provide statistics that will enable us to determine the direct effect on employment in the economy and in the chemical industry.

How has technological change affected employment? There are two opposing views as to exactly what the effects of automation are.[1]

One view, expressed by the Subcommittee on Economic Stabilization to the Joint Committee on Economic Report in 1955 relatively early in the onslaught of automation,[2] holds that this new technology or automation will cause whole new industries to arise, producing goods and services we never had before, and this will create a demand for more jobs. Consequently (in this view), everyone would benefit. Workers would have jobs and the consumer would enjoy the additional goods and services. In defense of their belief, this group points to the history of technological change in the United States. Historically, technology has created more jobs and goods and services and, as a result, today the United States enjoys a very high standard of living in comparison with most of the other countries of the world. The assemblyline technique greatly increased Ford's productivity in 1913; direct labor requirements were cut by 90 percent. But sales increased so rapidly that it was necessary for Ford to hire more workers to keep pace with the demand. This historical pattern, as illustrated by the example, is the basis for the argument that machines make jobs.

The opposing view is that automation will take the place of men in the factories without creating demand for their labor, the result being unemployment and economic hardship for the worker. This group argues that we can no longer expect the historical pattern to continue. They say first that the economic environment has changed—that most goods-producing industries have the market for consumer goods relatively saturated. Almost everyone has a refrigerator, a television set, washing machine, automobile. The market for these basic consumer goods is more saturated than 10, 20, and 30 years ago. The result is that automation now enables the goods-producing industries to satisfy consumer demand while employing fewer workers. Evidence of this in the United States is discernible in the shift in emphasis from the production of goods to the production of services (banking, health care, education, and government services).

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[1] For a discussion of these two views see: Charles C. Killingsworth, "Automation, Jobs, and Manpower." Statement for Subcomm. on Employment and Manpower, U.S. Senate, Sept. 20, 1963.

[2] *Automation and Technological Change*, Report of the Subcomm. on Economic Stabilization to the Joint Comm. on Economic Report, 84th Cong., 1st Sess., 1955.

TABLE 1. EMPLOYMENT IN MAJOR INDUSTRY GROUPS

Industry	*(in thousands)*		*Amount of change*
	1957 1st Q	*1964 1st Q*	
Agriculture	5,187	3,980	−1,207
Mining	821	612	− 209
Contract construction	2,612	2,690	+ 78
Manufacturing	17,281	16,989	− 292
Transportation, public utilities	4,209	3,879	− 330
Wholesale and retail trade	10,671	11,893	+1,222
Finance, insurance and real estate	2,431	2,885	+ 454
Service and miscellaneous	6,566	8,363	+1,797
Government	7,552	9,802	+2,250

Source: U. S. Bureau of Labor Statistics.

As can be seen from the table 1, the only goods-producing industry which gained in total employees was contract construction, while employment in all the other goods-producing industries actually declined. In contrast, employment increased in every service industry over the same period. While some would say that those who became unemployed have apparently found jobs in the service industries, this is not altogether true. This argument leads us to the next defense of those who say automation is causing unemployment. They argue that today our unemployment rate is high and has been creeping upward since the early fifties. In 1951–53, the average unemployment rate was about 3 percent.[3] From the first quarter of 1961 to the first quarter of 1964, the rate of unemployment never fell below 5½ percent.[4] It is interesting to note that after each major recession since the 1950's, the unemployment rate remained above the rate prior to each recession. While the unemployment rate today is 4.3 percent (October 1965), this rate is somewhat influenced by the additional demand for military goods in the Vietnam war.

For Canada, increasing productivity and a lagging growth have also had a great impact on employment. From 1947 to 1956 the average unemployment rate in Canada was 3.3 percent, while the average for the period from 1957 to 1964 was 6 percent.[5]

To summarize, those who argue that automation has had and will have adverse effects on the economy's employment point to the shift in emphasis from the goods to the service industries and point to the high rate of unemployment.

These and other facts seem to support the opinion that automation will have adverse effects if corrective measures are not taken.

Because automation increases productivity (output per man-hour), the rate at which automation is progressing can be seen from a study of the increase in productivity in the economy of the United States.

TABLE 2. ANNUAL PRODUCTIVITY INCREASE

Period	*Average annual percent increase*
1909–63	2.4
1947–63	3.0
1957–63	3.1
1960–63	3.6

Table 2[6] indicates the percentage increase in productivity in the past few years. The difference between 3.1 and 3.6 percent may not seem large, but this represents a 16 percent increase.

How does this increase in productivity affect the number of jobs available in the economy? If the total production of the economy did not increase (i.e., the total value of all the goods and services produced by the economy, more commonly referred to as gross national product —GNP), fewer workers would be needed because the productivity of each worker is increasing. In 1964, there were approximately 60 million persons in the private labor force (i.e., excluding government). Using a 3 percent productivity figure, we find that 1.8 million fewer jobs (3 percent × 60 million workers) would be needed if GNP did not increase. Said in another way, just to keep pace with the increase in productivity GNP must increase 3 percent in order to keep the present work force employed. During the postwar decade, GNP for the private economy (i.e., excluding government) has increased about 3.5 percent annually.[7] In the recent past, from the first quarter of 1961 to the first quarter of 1964, GNP has increased about 4 percent.[8] While this demonstrates that GNP has grown enough to provide for the number of jobs eliminated by productivity, it has not grown enough to accommodate all of the workers coming into the labor force. The result has been the high unemployment rate referred to earlier.

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[3] Killingsworth, *op. cit.*

[4] *Canadian Statistical Review*, Dominion Bureau of Labour Statistics.

[5] Ewan Clague, "Employment, Automation, and Economic Growth in the United States," Paper for the 13th International Conference of Gottlieb Duttweiler Institute for Economic and Social Studies, Zurich, Switzerland, July 6-9, 1964.

[6] *Ibid.*

The 1964 *Manpower Report* stated that when productivity and net additions to the labor force are considered, "growth in output (GNP) equivalent to a minimum of 25 or 26 million jobs, about 3¾ million a year, will be required during the next 7 years if we are to attain and maintain full employment." [9] This means private GNP would have to grow more than 4½ percent a year.

In Canada, the annual growth rate in GNP averaged 4.1 percent between 1950 and 1963 and 7.2 percent since 1960.[10] As a result of the increase in productivity in Canada, it has been stated that "to maintain current levels of *unemployment* we would have to achieve an annual rate of growth of real GNP . . . of from 6.0 to 6.5 percent." [11] The Economic Council of Canada has emphasized that if the Canadian economy is to achieve goals anticipated by 1970, it must find a million-and-a-half new jobs.[12] A conservative estimate would show that GNP must increase annually at 8.5 percent if these goals are to be achieved.

Automation, then, which has caused the increase in productivity, has also been a contributing factor to our high unemployment, and it will continue in the future to be a contributing factor if corrective measures are not taken.

Other Implications of Automation

So far this has been a discussion of the quantitative effects of technology and automation. However, there have also been other very important effects of automation.

Shifts in Industry Groups. Previously we showed the shift in employment from the goods to the service industries. Because automation has affected the goods industry first and because of the shift in demand for more services, employees were forced to find work in the service industries. It should be noted that there was a net loss in employment in the goods industries. Many specific goods industries gained employees while the other specific industries lost employees. Losses occurred where automation enabled the industry to meet demand for their product with fewer workers or where demand for the product actually fell off. Because many of these workers previously did "production type" work they had to be retrained for their new jobs.

Occupational Shifts. Also as a result of automation there has been a large shift in the composition of the work force. Automation has resulted in a sharp increase in white-collar jobs over blue-collar jobs. In the United States from 1947 to 1964 the number of blue-collar workers in all manufacturing actually *decreased* 1.4 percent while-collar employment *increased* by 75.9 percent.[13] While in Canada for the same period there was no actual decrease in blue-collar jobs, proportionally there was a much larger increase in white-collar jobs. For the blue-collar sector in all manufacturing employment increased only 13.1 percent while white-collar employment increased 44.1 percent.[14]

In general, the shift from goods to services has created more white-collar jobs. Not only were proportionally more white-collar workers hired, employees also changed job collars. Again this shift in proportion varied from industry to industry but the net effect was proportionally more white-collar workers. In the manufacturing industries many of these white-collar workers are engineers, technicians, or scientists. Because the new automated machinery requires more technical skills, the demand for these workers has increased greatly.

Effect on Skills. Automation is having a very definite effect on job skills. We have indicated that automation causes net unemployment. More specifically, however, what kind of jobs are eliminated? Studies indicate that it is the job of the unskilled worker which has been affected. These studies point to the unemployment rate which has increased for unskilled workers while this rate for the more skilled workers has remained the same or increased only slightly.[15] It is important to note also that it is the unskilled worker who, because of his general educational level, has had the most difficult time in finding other employment.

However, many skilled trades have also been eliminated. The 1960 Census of Population lists more than 80 occupations—many of them skilled—in which employment declined since 1950. These included locomotive engineers, boilermakers, loom fixers, stonecutters, and some highly skilled trades in the printing industry.[16]

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[7] Leon Greenberg, "The Relationship of Automation, Productivity, and Employment, Current Developments In The United States," Statement before the Interstate Conference on Labor Statistics, Miami, Fla., June 16-19, 1964.

[8] Clague, *op. cit.*

[9] *Manpower Report of the President*, Mar. 1964.

[10] J. P. Francis, Address to "North American Joint Conference on Requirements of Automated Jobs," *The Labour Gazette*, Feb. 26, 1965, and *Business Review*, Bank of Montreal, July 31, 1964.

[11] *Ibid.*

[12] Claude Jodoin, "Automation and Retraining," *Canadian Labour*, Mar. 1965.

[13] *Employment and Earnings*, Bureau of Labor Statistics.

[14] *Employment and Payrolls* and *Man-Hours and Hourly Earnings*, Dominion Bureau of Labour Statistics.

[15] The Diebold Group, Inc., *Automation: Impact and Implications, Focus on Developments In The Communications Industry*, Apr. 1965.

Of course new skills have also been created. Some of these are entirely new while others are a result of combining old jobs which, therefore, require a combination of skills and are in this sense new.

In some cases existing skills are downgraded; for example, an experienced and skilled craftsman may operate a relatively simple mechanism. In other cases skills are upgraded as a result of adding the new machine to the job.

Frequently, the responsibility which a worker has is greater after automation. While the machine may take over some of the duties of his old trade, he must correct errors that result in the process or on the part of the machine. Where his responsibility has been increased he must learn to react to this responsibility and in this sense his skill is certainly upgraded. It is interesting to note that the prevalent job evaluation plan in the steel industry gives more emphasis to responsibility factors than to skill factors.[17]

There is, however, a dispute as to the net effect of automation on skills. Some say it reduces them while others hold to the contrary. The [former] commissioner of the Bureau of Labor Statistics gathers this generalization from the data. "The over-all patterns of employment seem to demonstrate that technology, as such, even apart from other factors, is operating to raise skill levels generally." [18]

Education and Skills. Whether or not automation upgrades skills, it is a fact that automation demands that the educational level of the work force be increased. Automation has increased the tempo of industrial change which requires workers to work in varied occupations during their working years. The ability to adapt to this situation greatly depends on the basic educational skills. As one writer has stated, ". . . although both education and skills are the determining factors in total unemployment rates, it is better education which increases the convertibility of skills and, in a rapidly changing economic environment, appears to be of growing importance in terms of employment." [19] This great need for flexibility means that workers must increase their basic educational skills. Today, most of the major chemical companies hire only high school graduates.

Working Conditions. Automation has created an entirely new environment for the worker. This new environment imposes hardships greatly different from the speedups and the sweatshop conditions. A worker may now find himself isolated with his machine. This imposes a self-discipline and "monotony variable" not previously experienced because he could communicate with other workers. Generally speaking, automation also tends to transfer control over the rate of production from the worker to the machine. This creates problems which will be discussed later.

Effect on Reemployment and Retraining. While we have already discussed the problem that automation may cause unemployment in great numbers, automation also has an effect on the ability of the worker to find new employment. As pointed out previously, frequently the worker must transfer from a goods to a service industry, which may be a different "type" of employment experience to which he must adjust.

There is also the large area of retraining. Workers simply are not always willing to be retrained. Skills accumulated over a long period are not easily displaced or replaced. The older worker may also be psychologically unable to make an extensive job change, while the younger worker has no bank of experience and skills from which to draw. The mental pace of the new technology, the requirement of constant attention to numerous gages, dials, and other instruments, and the assumption of new and greater responsibilities may create mental blocks which are insurmountable or, at best, require long periods of training. [Former] commissioner of the Bureau of Labor Statistics Ewan Clague has stated that, "The difference with technological unemployment is that it eliminates skills and occupations—the same old jobs do not open up again, either next season or next year. Such an unemployed worker must not only find a new job, he must tackle a new occupation for which he may lack both the skill and the training." [20]

Automation Brings Social Responsibilities

In the discussion so far it has been shown that automation has had and will continue to have a dynamic impact on the economy and on the society as represented by the worker. We have pointed out the problems created. These problems will have a drastic effect if measures are not taken to deal with them. The discussion that follows points out what must be done to accommodate the new technology.

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[16] Ewan Clague, "Effects of Technological Change on Occupational Employment Patterns In The United States," Statement before the Conference on the Manpower Implications of Automation, Organization for Economic Cooperation and Development, Washington, D. C., Dec. 8, 1964.

[17] Charles Killingsworth, "Industrial Relations and Automation," *Annal of The American Academy of Political and Social Science*, Mar. 1962.

[18] Clague, *op. cit.*, Dec. 8, 1964.

[19] Diebold Group, Inc., *op. cit.*, p. 140.

[20] Ewan Clague, "The Impact of Technology Upon Manpower," Summary of Remarks at the 16th Annual Conference of the Greater Chamber of Commerce, Philadelphia, Pa., Jan. 10, 1963.

Economic Growth & Employment. We have pointed out the effect of automation or productivity on overall employment in the economy. We have shown that unemployment will continue to plague us unless GNP increases sufficiently. More specifically, what is the effect of high unemployment? The answer, in short, is that aggregate demand for goods and services declines when unemployment increases. Workers do not have full paychecks and they cannot make their ordinary purchases. When demand falls off business must lay off workers who, in turn, must curtail some of their purchases, and the cycle continues. The ultimate affect is that GNP, instead of increasing, may actually decrease or, at any rate, does not grow in the proportion needed to compensate for the effects of automation.

Every company, then, has the responsibility of helping to maintain employment. If employment is not maintained both the company and the individual will be adversely affected in the long run. In the chemical industry the effect of declining demand will be more immediately felt than in other industries, for to produce $1 of sales the chemical industry must purchase 35¢ worth of product from other chemical producers.[21] It has been stated that the chemical industry is its own best consumer. This intra-industry dependence means that if demand falls off in one area of the industry it will have an almost immediate effect on other chemical producers.

The chemical industry accounts for a large share of the total product produced by all manufacturing industries. How the chemical industry treats its employment problems will affect not only the chemical industry but will also have a sizable affect on the entire economy.

In essence, industry must find a place for the unemployed worker as well as the new worker or suffer the consequences. Because the economy is so interrelated every company must contribute towards making full employment possible. One interesting feature about automation stands out. It is that much of the productive capacity (our automatic machines) does not operate at near full capacity. This machinery is exceedingly expensive yet management does not get full use from it. Frequently it will be replaced with other equipment which has greater productivity powers simply to hedge on future demand. It is our suggestion that management look more closely at its plant facilities to determine if it would be more economical in some cases to add workers to machines which are not working to near full capacity instead of replacing these machines.

In addition, management should plan its automation at a time when unemployment is low so that the increased productivity will not displace more workers and worsen the unemployment problem. This practice has been encouraged by the President's Advisory Committee on Labor-Management Policy.[22]

Skills, Training, and Transition. In our analysis we have shown that engineers, technicians, scientists, and skilled craftsmen will be needed in increasing number to operate the automated plants. In addition the shift of demand to services will also mean more teachers and more nurses, for example.

To obtain these and the products from the automated plant people will have to be trained to do these jobs. Studies show that there is short supply for some of these jobs. It must be remembered that if these people are needed and are not available this will affect the number of other employees who will have work.

One theory is that the unemployment rate in the recent past has been structural. By this is meant that jobs are available but there simply are not enough qualified people to do them. Some of our unemployment is structural and in order to correct this, skills must be upgraded.

This does not only mean we need college graduates; it also means that companies must learn to upgrade (retrain) their present employees to do some of these jobs. The fact is that there is not enough of this kind of training by companies, chemical companies in particular. The unskilled must be helped to qualify for another job by a public agency or by the company which has terminated them. Surely the high unemployment rate is due in part to workers' inability to find jobs which suit them or for which they are suited.

Once trained, a placement service which would enable them to have a better selection would surely facilitate their reemployment.

Education and Automation. As we have shown, the worker must possess basic educational skills or he will not be "convertible" (employable) in this automated age.

The fact is that today many of the young workers entering the labor market for the first time are high school and junior high school dropouts. These workers will experience an exceedingly hard work life in terms of job security.

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[21] "The Interindustry Structure of the United States—A Report on The 1958 Input Output," *Survey of Current Business*, Nov. 1964.

[22] The President's Advisory Committee on Labor-Management Policy, Jan. 11, 1962, "The Benefits and Problems Incident to Automation and Other Technological Advances."

For many of these persons, however, our public school curriculum is simply out of date. They should be given a more extensive opportunity for vocational education. This type of education would provide them with at least some skill and would undoubtedly hold their attentions much better.

For the uneducated worker already in the work force, employers should provide part of the expense for night classes to encourage him to upgrade his basic educational skills.

Summary. These, then, are some of the social responsibilities which must be assumed if automation is to be a blessing instead of a curse. Because automation has such diverse ramifications the problems it creates cannot be solved by labor and management or any other single group in the economy. Each group must contribute its necessary part.

It is our belief that no one sector of the economy should prosper and enjoy the benefits of automation while another group shoulders the burden of this new technology. We are in complete agreement with Assistant Commissioner of the Bureau of Labor Statistics Leon Greenberg when he said, "Thus, we see that improving technology and productivity can bring and has brought benefits to a very large part of our society. At the same time, a small but important part of our society has borne the cost of improvement for the many. This group is made up of the worker who becomes unemployed or loses his earning power because of technological and related changes. We do not think that the burden of technological change or any other kind of involuntary unemployment should be borne by these few individuals." [23]

Said another way, the fruits of automation must be shared with those unfortunate workers who either cannot adapt or who find it exceedingly difficult to do so.

Automation in the Chemical Industry

In the post-World War II period the technology of the chemical industry has become so modern that it has changed old relationships. This new technology, or automation as it has become known, has caused changes in the content of work still performed by man and changes in who does the remaining work. It has also affected the existence of employment itself. An analysis of the effects of this new technology on the chemical industry follows.

While our purpose is not to examine the different definitions of automation that have been offered, some brief mention should be made about the characteristics of automation machinery. This machinery does differ from previous types of machines. The distinguishing feature of the new machinery is that it is self-regulating in some form or other and to some degree.[24] In some cases instruments measuring temperature, pressure, etc., are wired to computers which, in turn, regulate the instruments and the production of the product. The basic principle of control in the new technology is very similar to your home thermostat. Of course the degree of self-regulation in automation varies. Not all automated processes use computers, for example. And there are variations on the complexity of the measuring instruments.

Basically, however, these various combinations of machinery have been grouped to describe several stages or degrees of automation[25] in the chemical industry.

1. Batch operation. Operator initiates the action, controls the cycle based on instrument readings, observation, laboratory analyses, etc.
2. Semicontinuous operation or nonautomatic continuous operation. Both of these involve a higher degree of instrumentation, but the operator still runs the process.
3. Automatic continuous operation. Process is controlled by pneumatic or electronic means, each loop having an individual controller. Instruments make their own measurements, determine at each moment the amount by which the controlled variable is in error, and apply the necessary correction to the control valve or other final element. By the feedback principle that "closes the loop," the instrument then measures the effect of the change and, if needed, applies another correction. Operator is alerted if process goes out of control; he may also initiate action during startup, shutdown, or equipment failure.
4. Open-loop computerized operation. The computer that is added to the conventional instrumentation calculates and evaluates data but does not make instrument adjustments. It may issue printout instructions to the operator. Control is on finite-interval (digital) rather than continuous basis.
5. Closed-loop computer control. In supervisory or optimizing type of control, a digital computer calculates the optimum control setting for the instruments (which are of conventional type) and corrects the settings automatically. In "direct digital control," which is on the verge of becoming practical, instrumentation is simplified; a single high-speed special-purpose com-

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[23] Leon Greenberg, "Productivity and Technological Developments In The United States," Statement before 13th Annual Meeting of the National Council on The Aging, Edgewater Beach Hotel, Chicago, Ill., Feb. 11, 1964.

[24] Hebert Poper, "CPI Manpower, The Dynamic Trends and What They Mean," *Chemical Engineering*, Oct. 12, 1964.

[25] *Ibid.*, p. 190.

puter is time shared among a large number of control loops. Under "dynamic optimization," the process is controlled by the computer during startup, shutdown, and recovery from disturbances, as well as at normal conditions.

6. Closed-loop control with economic override. In controlling the process, the computer integrates economic factors, such as fluctuations in the relative cost of raw materials, changes in byproduct or coproduct demand, and price-quality factors. Each process will run at optimum conditions within the overall plant operation.

Production in the chemical industry lends itself easily to the use of these automatic devices. Chemicals are liquids, solids in powder form, and gases which can be readily mixed and transported by pumps or blowers through pipelines by power-operated equipment. These processes, as a rule, are on a continuous basis—24 hours a day, 7 days a week.

TABLE 3. PRODUCTION IN CHEMICAL AND TWO OTHER INDUSTRIES AND ALL MANUFACTURING, UNITED STATES, 1947 AND 1964 (PRODUCTION INDEX, 1957–59 = 100)

Industry	*1947*	*1964*	*Percent change*
CHEMICAL	41.5	159.4	+284
Industrial chemical	34.8	178.0	+411
Drugs	N.A.	N.A.	—
PRIMARY METALS	90.7	128.2	+ 41.3
Basic steel products	93.8	126.5	+ 34.9
TRANSPORTATION EQUIPMENT	42.9	130.7	+204.7
Motor vehicles and equipment	69.4	150.1	+116.3
ALL MANUFACTURING	66.4	132.9	+100

Source: Federal Reserve Board

How automated is the chemical industry in comparison with other manufacturing industries? While we cannot make a comparison of the complexity of the machines themselves, we can study what their effect is on the total production of the product. In addition, there are other measures which indicate how automated an industry is.

TABLE 4. BLUE-COLLAR EMPLOYMENT IN CHEMICAL AND TWO OTHER INDUSTRIES AND ALL MANUFACTURING, UNITED STATES, 1947 AND 1964

Industry	*Blue-collar employment*[1]		
	1947[2]	*1964*	*Percent change*
CHEMICAL	488,000	528,700	8.3
Industrial chemical	(3)	163,300	—
Drugs	59,900	59,500	− 0.7
PRIMARY METALS	1,114,000	998,200	− 10.4
Basic steel products	575,000	512,000	− 11.0
TRANSPORTATION EQUIPMENT	1,039,000	1,133,300	9.1
Motor vehicles and equipment	626,000	593,200	− 5.2
ALL MANUFACTURING	12,990,000	12,808,000	− 1.4

[1] Production and maintenance workers.
[2] Denotes the beginning of the postwar period.
[3] Not available.
Source: Bureau of Labor Statistics.

TABLE 5. WHITE-COLLAR EMPLOYMENT IN CHEMICAL AND TWO OTHER INDUSTRIES AND ALL MANUFACTURING, UNITED STATES, 1947 AND 1964

Industry	*White-collar employment*[2]		
	1947[1]	*1964*	*Percent change*
CHEMICAL	161,000	348,600	116.5
Industrial chemical	(3)	121,800	—
Drugs	26,500	52,600	98.5
PRIMARY METALS	165,000	228,300	38.4
Basic steel products	80,800	112,900	39.7
TRANSPORTATION EQUIPMENT	236,000	489,300	107.3
Motor vehicles and equipment	142,000	177,800	25.2
ALL MANUFACTURING	2,555,000	4,495,000	75.9

[1] Supervisory personnel, office workers, salesmen, and professional employees.
[2] Denotes the beginning of the postwar period.
[3] Not available.
Source: Bureau of Labor Statistics.

Let us first consider production. With these machines the product itself can be made at a faster rate; hence, productivity is increased and hence more total product can be made. Table 3 compares production in the chemical industry in the United States with production in two other leading industries and with all manufacturing for 1947 and 1964.

As can be seen in table 3, the total production in the chemical industry increased 284 percent. This was greater than the increase of the leading industries and almost 3 times greater than all manufacturing.

This information, coupled with the data in tables 4 and 5, indicates the contribution of the machine and the contribution of production and maintenance men to this total production.

While production in the chemical industry increased 284 percent between 1947 and 1964, the number of production and maintenance workers increased by only 8.3 percent. At the same time the number of white collar workers increased by 116.5 percent. As a result of this large increase in growth of white-collar em-

TABLE 6. PRODUCTION IN CHEMICAL AND TWO OTHER INDUSTRIES AND ALL MANUFACTURING, CANADA, 1951 AND 1964 (PRODUCTION INDEX, 1949 = 100)

Industry	*1951*	*1964*	*Percent change*
CHEMICAL	120.0	279.0	132.5
Industrial chemical	(1)	(1)	—
Drugs	(1)	(1)	—
PRIMARY METALS	115.9	195.7	68.9
Basic steel products	129.0	244.9	89.8
TRANSPORTATION EQUIPMENT	131.3	198.5	45.1
Motor vehicles and equipment	139.3	245.8	76.5
ALL MANUFACTURING	115.0	188.2	63.7

[1] Not available.
Source: Dominion Bureau of Statistics.

TABLE 7. BLUE-COLLAR EMPLOYMENT IN CHEMICAL AND TWO OTHER INDUSTRIES AND ALL MANUFACTURING, CANADA, 1951 AND 1964

Industry	*Blue-collar employment*[1]		
	1951	*1964*	*Percent change*
CHEMICAL	28,889	30,093	4.2
Industrial chemical	5,508	6,696	21.6
Drugs	3,845	3,020	− 21.5
PRIMARY METALS	87,631	92,647	5.7
Basic steel products	31,159	35,117	12.7
TRANSPORTATION EQUIPMENT	109,002	109,584	0.5
Motor vehicles and equipment	44,226	51,260	15.9
ALL MANUFACTURING	824,483	932,087	13.1

[1] Production and maintenance workers.
Source: Dominion Bureau of Statistics.

ployees, the ratio of production workers to nonproduction workers has changed drastically. In 1947 there were more than three production workers for each nonproduction worker, while in 1964 there were only little more than one and one-half production worker for each nonproduction worker. These figures clearly demonstrate the great increase in output per production worker. Said in another way, these figures demonstrate how the machine has greatly reduced the need for production and maintenance workers.

TABLE 8. WHITE-COLLAR EMPLOYMENT IN CHEMICAL AND TWO OTHER INDUSTRIES AND ALL MANUFACTURING, CANADA, 1951 AND 1964

Industry	*White-collar employment*[1]		
	1951	*1964*	*Percent change*
CHEMICAL	20,407	28,707	40.7
Industrial chemical	1,323	3,627	174.1
Drugs	4,221	5,324	26.1
PRIMARY METALS	20,222	28,799	42.4
Basic steel products	4,294	7,736	80.2
TRANSPORTATION	23,411	32,611	39.3
Motor vehicles and equipment	9,886	15,222	54.0
ALL MANUFACTURING	267,387	386,358	44.5

[1] Supervisory personnel, office workers, salesmen, and professional employees.
Source: Dominion Bureau of Statistics.

As can be seen in the tables 6, 7, and 8, production in the Canadian chemical industry from 1951 (the first year for which data on the number of production workers are available) to 1964 increased 132.5 percent, more than double all manufacturing, while production and maintenance workers increased only 4.2 percent and white-collar workers increased 4.7 percent. In Canada, the ratio of production workers to nonproduction workers changed from three production workers for every two nonproduction workers in 1947 to almost a one-to-one ratio in 1964.

How will the chemical industry grow in the future? In the United States in the last decade the production of chemicals has increased at an annual rate of 7.5 percent. Production is expected to grow by at least 6 to 7 percent a year through 1970.[26] During this same period total employment has increased about 1.75 percent a year. The National Planning Association predicts that the annual growth rate will be about 2 percent between now and 1970.[27] However, the increases are expected in white-collar jobs with very little increase and perhaps a decline in blue-collar workers.

How much more automated will the industry become? Statistical indicators point to a moderately automated chemical industry at present. It has been stated that, "Many well-known plants in the CPI have already progressed to a fairly high step . . . but they do not represent a vast bulk of CPI output." [28] Another indication of the extent of automation is the amount of capital investment per blue-collar worker. In 1962 the petroleum industry, the most highly automated industry, had an investment of $110,700 per blue-collar worker while chemicals figured $43,700 and all manufacturing only $21,800.[29] If this is an accurate measure of the extent of automation, chemicals—while still ahead of other leading industries in comparison—has yet the bulk of its industry to automate. In 1963, the chemical industry spent $1,464 million on new plant and equipment. McGraw-Hill's department of economics indicated in 1963 that chemical process industries "will spend" $250 million on automatic process-control equipment and instrumentation.[30] This would be approximately 17 percent of total expenditures on new equipment in that year. The source also indicated that expenditures on automatic equipment are "leaping 10–20 percent annually." Another indicator of the increase of automation in the chemical industry is the number of computers used. In 1963 there were 350 process control computers in operation. A lengthy study, however, indicated that the number of these computers in the industry would grow to 4,000 by 1970.[31] These facts seem to indicate that automation in the chemical industry in the United States will continue to maintain its present growth rate to at least 1970.

While we do not have comparable information for the Canadian chemical industry, the following conclusions would seem to be applicable to the chemical industry in both countries because of the similar relationships of plant size, product, and corporate entity in the industry.

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[26] David Keefer, "The Chemical Industry, Special Report," *Chemical and Engineering News*, Aug. 12, 1963.

[27] *Ibid.*, p. 81.

[28] Popper, *op. cit.*, pp. 191-192.

[29] "Capital and Employment In Manufacturing," National Industrial Conference Board, July 15, 1965.

[30] "Crisis In Labor," *Chemical Week*, Feb. 23, 1963.

[31] Summary of a study on automation by Corplan Associates, affiliate of IIT Research Institute, *Chemical Week*, Aug. 1, 1964.

It seems automation in chemicals will continue to occur mostly in the large chemical plants as it has in the past. The small plant faces the deterrent of cost (automated equipment is expensive) and will probably not automate as rapidly.[32] (Small plants can afford not to automate because they can do well in special product fields where competition is less severe.) However, it should be noted that in the United States small plants (50 employees or less), while they represent approximately 82.7 percent of all plants in the industry, account for only 15.8 percent of the total employment.[33] In Canada these small plants represent 80.6 percent of all establishments in the industry and 20 percent of industry employment.[34] Another fact to remember is that the great percentage of these small plants are single-unit companies. From this we can assume most automation will take place in the large plants producing standard chemicals owned by the multiunit companies (the giants in the industry) until such time as costs of automated equipment make its introduction feasible in the small plants.

Certainly, our union has little, if any, "breathing space" in which to prepare itself for the completely computerized society of the future. While high profits in existing plants mitigate against a complete conversion to computers, the fact is we are experiencing plant closings and relocations at an increasing rate.

Collective Bargaining and Automation

Management Rights—Advance Notice. When decisions are made to automate or introduce new equipment into the plant, the company will usually discuss the changes with the union committee. However, whether or not the union will receive anything more than a perfunctory hearing will depend on the protections written into the labor agreement.

Management may rely completely on the management rights clause in the agreement as justification for its contemplated moves. Only if the contract has adequate provisions which guarantee "union rights" will the union be able to handle the problem intelligently and to the satisfaction of the workers.

First, the contract should ensure that advance notice of changes be given to the union so that discussions may be held on the matter. Secondly, the contract should provide that contemplated changes will be subject to mutual agreement or, at the very least, arbitration. Sometimes a joint committee can agree on the introduction of new equipment while making adequate provisions to insure that no worker will be laid off or lose earnings as the result of the changes.

New Or Changed Jobs. In almost every case of technological change, the introduction of new processes or equipment will necessitate the creation of new jobs or the merging of existing jobs. It is important that the union insist on contract language which will protect the labor standards of the contract.

Specific provisions must be written into the contract concerning the handling of new or changed jobs. The union must have the right to grieve the new wage rate and job description. Arbitrators must have the power to set rates and write job descriptions in accordance with the present practices in the plant.

Employment Security. As previously pointed out, automation has in many instances displaced the employee from his job or downgraded his skill. Where the former effect is felt, the employee is concerned with retaining some kind of employment. In such cases, seniority should be the guide to placing the employee in another job in the plant. However, because a "bumping" procedure has the end result of displacing some employees, attempts should be made to retain all employees. The union should try to negotiate a clause whereby no employee is put on layoff but that any reduction of the work force will be by attrition only (quits, discharges for cause, deaths, retirements, etc.). Where the immediately affected employee cannot be placed in another job, he should be permitted a reserve status in a surplus pool. He should be trained for another job while in this reserve status and should also receive protected pay during the period. In no event should any employee lose any benefits or wages as a result of technological change.

In those plants employing women, the turnover or quit rates are normally quite high. It should not, therefore, be a costly item for companies employing women (drugs, soaps, cosmetics, etc.) to guarantee that there will be no layoffs because of technological change and that any reduction of the labor force will occur through attrition. Each local union should determine from the company and union records the amount of turnover in employment and use this argument where applicable.

Seniority–Recall. It is impossible to predict the complete effect of automation on the existing work force beforehand. Although only a few jobs may be affected in one instance, in another whole departments may be wiped out. Therefore, we should insist that job layoffs and transfers must be made on the basis which will protect the older, more experienced worker. In any event, our agreements should include a provision that no person should ever be laid off from the plant unless he is the least senior person in the plant.

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[32] "Automation," *Chemical Engineering*, Jan. 18, 1965.

[33] *Enterprise Statistics*, 1958, U.S. Department of Commerce.

[34] *General Review of The Manufacturing Industries Of Canada*, 1961, Dominion Bureau of Statistics.

Following layoff, the employee should have recall rights to any job openings which may occur before new workers are hired. This period of "retention of seniority for recall purposes" should not have a time limit imposed on it.

Retraining. It is a responsibility of management to retrain displaced employees for new jobs which may be created at the expense of existing jobs. The union should include in the labor agreement necessary language to provide for this retraining. Any cost to the employer can easily be met by the savings in labor cost and the increased productivity which is concomitant with automation.

Transfer, Relocation, and Preferential Hiring. Because automation has created unemployment and because the use of automated devices is brought about by management decision, management has the responsibility of stabilizing employment for its workers who have faithfully performed their assigned duties and may now be faced with job loss. We have already suggested job protection by an attrition clause. There are also other means of assuring jobs to displaced workers.

In multiplant companies employees may be given the opportunity of transfer to another plant of the company where there may be job openings. The right to transfer should also include the right to move at company expense. This is sometimes called a relocation allowance, which sometimes includes payment for any loss suffered in the disposal of the employee's present home and any additional cost of a new home in the new location. It is also necessary that the employee receive his regular pay during the period of the move.

Where job relocation is not an immediate possibility, the company should agree to establish a preferential hiring list from which it agrees to staff any other plants as openings occur.

Supplementary Unemployment Benefits–Severance Pay. Where the union is unable to secure agreement that no worker will be laid off due to automation, it is possible to aid laid-off workers in other ways. One of these ways is by supplementary unemployment benefits which are paid by the company and added to State unemployment insurance benefits. SUB was first introduced in the 1950's and can be found today in auto and steel agreements. The theory behind SUB is that the low State unemployment compensation benefits need to be supplemented so that the unemployed worker can maintain his standard of living while he searches for a new job.

Another way to ease the plight of the unemployed worker is to provide him with a severance, termination, or layoff pay. The terms are usually interchangeable and are only descriptive of plans whereby the unemployed worker receives payments, usually according to his service, when he is laid off. These payments may be made in a lump sum or paid weekly. The theory of income maintenance is also part of the reasoning behind these plans.

Early Retirement. One way to ease the plight of displaced workers, and possibly create job openings at the same time, is to make the early retirement provisions of retirement plans more attractive. The recently negotiated UAW pensions, for instance, now provide that a worker may retire at age 60 and receive $400 per month until he is 65 years of age and will receive Social Security. As a result, many auto workers have decided to retire, thus making more job opportunities available and also making layoffs unnecessary.

Paid Time Off. Every time we negotiate additional holidays and extend vacations, we are helping to create job opportunities or reducing the necessity for layoff, assuming, of course, product demand is constant or rising. Thus, provisions which allow paid time off are applicable, in at least a small way, to an overall discussion of automation and attempts to relieve its impact.

Considerable advances have been made in recent years in the amount of vacation time off negotiated with employers. Three weeks or more of vacation have been negotiated in a majority of ICWU contracts. Most recently, there has been a movement, stimulated by the Steelworkers, to provide workers 13 weeks' vacation every 5th year, with the normal vacation applicable to the other 4 years.

Paid sick leave plans and pay for jury duty also fall into the same category as holidays and vacations. They help provide some relief to workers who might otherwise be laid off.

Subcontracting. In recent years some companies have contracted out certain work which was normally performed by the union members. This has had tremendous impact on some unions and can be compared to the effects of automation. Thus, it is mentioned here.

Work which is subcontracted usually is in the category of work customarily performed by our members, but it may also include new work. In this regard, the union should include a clause in the collective bargaining agreement so that all situations will be covered.

Overtime. The pages of labor history are full of references to the continuing fight to reduce the workweek so that the worker may have leisure time to spend with his family. In 1965, the position of the AFL–CIO and the CLC is a 35-hour workweek. It is hoped that this will be accomplished through legislation in the near future. Until then, however, our local unions can make an attempt to reduce the workweek contractually, as did Local 7 when it recently negotiated a 37½-hour workweek with the Burroughs-Wellcome Company.

In conjunction with a reduced workweek, one must think of the tremendous number of overtime hours worked in industry. A recent study by the Bureau of Labor Statistics (*Employment and Earnings,* May 1964) showed all manufacturing average weekly overtime hours were 3.4 hours for production workers, the highest the figure has been since January 1960. For the chemical industry this figure was 2.8 hours of average weekly overtime. Many jobs could be provided if our contracts prevented the working of overtime hours or if they provided payments for overtime which were really penalty payments. Too many union members look upon the overtime clause as a way to increased earnings, when the purpose is to make overtime work so expensive that employers will not schedule overtime work. To keep overtime rates a true penalty payment, the AFL–CIO and the ICWU position is that all overtime should be paid at a minimum of double time.

Length of Agreements—Mergers—Plant Closings. The trend toward longer-term agreements in the chemical industry indicates that some second thoughts should be taken about this question in light of the possibilities for change brought about by introduction of automation, the possibilities of merger or acquisition, and the likelihood of department or plant closings.

The companies are interested in establishing stable labor costs for long periods of time, and unions are interested in securing the best possible economic package for their members. However, the highest wages and most liberal fringe benefits for active employees are small consolation to the worker who has been displaced from his job.

Unless the labor agreement provides proper safeguards for workers and restrictions on management decisions which will cover the above situations, then the greatest protection against job loss is a short-term agreement. If, however, the union has included in the contract these clauses suggested above, then the length of agreement is not as important and may be the lever for additional monetary and fringe gains.

ICWU-Management Employment Referral Service. Automation causes workers to change jobs many times during their worklife, frequently to entirely different types of employment and even in different industries. The need to assist unemployed workers is urgent. They first need to acquire a new job but, secondly, they need assistance in securing employment in the industry which needs their special skills and where they can fully capitalize on the training already received.

The ICWU and managements of chemical companies can play vital roles in helping workers to relocate by establishing an employment referral service. We call upon the various chemical companies to participate with us in providing such a service to the industry. The service would serve two functions—aid to the worker and assistance to the industry.

In this mutual assistance effort, chemical companies would report job vacancies and/or lists of surplus employees to the international union which, in turn, would provide this information to unemployed members and other companies. Anticipated layoffs and projected expansions could also be reported and the information circulated throughout the industry.

We believe such a service is a proper function of a responsible labor organization. We feel, too, that the managements of the industry recognize that they have a responsibility to unemployed chemical workers and will participate in this endeavor. Certainly, this exercise in cooperation will fill a vacuum which now exists in the industry, and will not only help the unemployed but, in reducing training costs, may even be considered as having monetary value to the companies.

STATEMENT

Prepared for the Commission
by the
International Longshoreman's Association
New York, New York

Statement by the International Longshoreman's Association, AFL-CIO

Automation—The Outlook for the Longshore Worker

Changes in the methods of cargo handling were considered a serious threat to the jobs and income of the longshore worker when the International Longshoreman's Association decided to take action in the fall of 1958 against uncontrolled introduction of such changes by employers in the shipping and stevedoring business.

On the eighth anniversary of that dramatic mass stoppage of longshoremen in the Port of New York it would give those of us who are responsible for leading the ILA great satisfaction to be able to report that we and the longshore industry have taken long strides toward solving the manpower problems that attend the continuing changes in cargo handling techniques and cargo vessel construction. The objective facts, however, do not permit any such report.

We have not solved those of our problems which may be traced to technological change. Labor and management have tried, and we have managed, to produce certain contractual accommodations. The results of our efforts are no more than a stop-gap "solution." The evidence to support this conclusion can be read out of the statistics compiled by the U.S. Department of Labor in 1964 and 1965. Jobs have disappeared at a phenomenal rate. In the contract year 1951–52 there were 51,282 men employed under longshore contracts in the Port of New York, the port area in which the most dramatic changes in cargo-handling technology have occurred. In the contract year 1961–62, the USDL reported only 27,134 men employed under these contracts, a drop of more than 24,000 workers. The number has declined still further in the period since the last contract year covered by the USDL survey.

In that 10-year period, total waterborne cargo tonnage and general waterborne cargo tonnage increased significantly. Total tonnage rose from 139,395,000 short tons in 1953 to 154,476,000 short tons in 1962. General cargo tonnage—that cargo which provides the principal source of longshore employment—rose from 12,061,000 long tons to 13,902,000 long tons.

It is also significant that declining employment and increasing cargo volume have been accompanied by a decline in total longshore hours worked in the Port of New York. In this port area there were 44,260,828 longshore hours worked in the contract year 1951–52. In 1962–63, the total had dropped off to 40,201,588 hours.

Not all of this decline in employment was adverse to the interests of the longshoremen. Some of it is traceable to justifiable decasualization of the longshore labor force. However, not all of the so-called "decasualization" has been accomplished in a manner designed to benefit to the longshore workers who have had a right to expect employment and income from work in this industry. Buried in the effects of the decasualization operations of the "temporary" bistate waterfront agency created by New York and New Jersey are job opportunity losses which are the consequence of unitization of general cargo, container ship utilization, the adoption of bulk cargo-handling facilities and techniques, and other significant equipment changes. Thus, while 47 percent, or 24,332 of the 51,282 men employed in 1951–52 worked 700 or more hours, the 83 percent of the 27,134 men employed in 1961–62 who worked 700 or more hours amounted to only 22,506 men so employed. In terms of total numbers, there were 1,826 fewer longshore workers employed 700 or more hours in 1961–62 than in 1951–52.

Clearly, the work force utilization percentages reported by the USDL are capable of misleading the unwary. The decasualization process managed by the Waterfront Commission of New York Harbor trimmed away longshore labor force which worked a minor part of the potential work-year, but methods changes trimmed away segments of the longshore labor force which worked a major part of the work-year as well as those who worked a minor part.

Longshore workers are earning less overtime income than ever before. In 1951–52 longshore employees' hours included 27.7 percent at overtime rates. In 1961–62 this proportion had shrunk to 23.5 percent, according to the USDL study. The proportion is even lower today.

One other rather odd phenomenon arises in the past 10 years out of the policies of the Waterfront Commission. According to USDL data, at the same time that between 757 and 948 longshoremen left the industry's labor force annually between 1958–59 and 1961–62 through death or retirement, and another 2,065 to 4,655 were being decasualized annually, the Waterfront Commission was registering new entrants into the longshore labor force at the rate of 1,990 to 2,854 per year.

The trends in these New York port area figures point up the job problem posed for past, present, and potential labor force in the longshore industry as a whole. The work of the industry is increasing, and it is being done by fewer and fewer men. There is great pressure being exerted by government agencies, by equipment manufacturers, cargo vessel builders, trucking operators, insurance carriers, and others to step up containerization and other forms of cargo unitization, and to increase the use of mechanized procedures for cargo loading. As the shipping lines and cargo handling firms respond more and more to these pressures, more longshore jobs will be lost. It may be true that average earnings per longshoreman will continue to rise under these conditions, but it is a foregone certainty that there will continue to be fewer longshormen around to enjoy these increased earnings.

The ILA began in 1958 its efforts to persuade the employers in the shipping industry to meet the job problems posed by new cargo handling technology decisively and before these problems caused their most serious impacts on the longshore employee. We used all of the techniques available to labor unions in a free society. The catalog of our endeavors is long:

1. We conducted mass demonstrations.
2. We retained an outstanding university economist and expert on manpower problems.
3. We insisted on the creation of an informal joint labor and management committee to study and discuss the problems surrounding automation, to work within the term of our collective bargaining contracts.
4. We took aspects of the problem to arbitration for binding decision.
5. We made automation a major collective bargaining issue in the industry's negotiations in 1959, 1962, and 1964, and we conducted strikes over the issue.
6. We presented urgent pleas to executive agencies and legislative committees of Government to study automation in the shipping industry and in other industries across the Nation.
7. We surveyed cargo handling methods in foreign countries where different methods and conditions of employment prevailed for clues to the handling of our own problems.
8. We studied the significance of each new kind of cargo handling equipment and each new idea for changing present methods of cargo handling, in an attempt to discover whether "progress" was likely to be the result of its application to cargo movement.
9. We met with government, industry, university and labor union specialists to exchange views and information on the subject of automation.
10. We participated in international conferences on automation.
11. Principal officers of the ILA made countless appearances before management groups in our own and other industries to stress the adverse job effects which can accompany thoughtless and hasty adoption of new industrial techniques.

These activities of the ILA did have some beneficial effects. We won protections of a sort for the longshore worker, and where we did not get results we at least got sympathy. But sympathy is only a preliminary condition for the solution of the problems involved. We were, for example, able to get the shipping industry to agree informally in January 1959 to a general statement of principles for approaching the technological problems of the shipping industry and the dockworker. It was this statement of principles which launched our joint labor and management committee on its quest for minimizing the hardships that can be visited on workers by changing technology, and for equitably spreading the benefits of such changes among workers, employers, and the community as a whole. In that statement to the longshore employers we said, in part:

> Our first obligation is to the longshore workers we represent in all of the Atlantic and Gulf ports. However, we are prepared to give careful attention to both the immediate and the future implications for business and the community of any proposals that come out of these discussions. Be assured that the Union is on the side of technological progress. We do not aim to obstruct or discourage progress. At the same time, our concept of progress does not involve casting longshore workers adrift without jobs or income. All we ask is that where there is progress, that it shall be progress for everyone—including the dockworker. One of the principles to which we will hold firm throughout the course of our discussions with the employers is that no program which calls upon the dockworker and his family to give up eating can represent progress.

However, it has been a far cry from an agreement on general principles to the achievement of a functioning program which spells both progress and security for industry and for labor in the face of automation.

Our current collective bargaining contract covering the period from October 1, 1964, through September 30, 1968, contains provisions which reflect the furthest point of advance in our campaign to meet worker and industry needs in this era of rapid technological change. I regret to have to report that we are still far from having produced a satisfactory solution to the job and income problems faced by the dockworker as a consequence of further changes in cargo handling methods. What we do have amounts to a stop-gap arrangement achieved through the ordeal of that traditional trial by economic combat, collective bargaining. Those provisions in our contracts with the shipping lines that have a bearing on dockworker security in this time of evolving technological change represent nothing more than a truce over the issues involved. We have yet to produce safeguards against the economic disaster that lies ahead for the dockworker as the shipping industry steps up its efforts to increase productivity through the adoption of labor-discarding methods of cargo handling.

We have since 1959 publicly and repeatedly called upon management to help develop a formal program of job and income protection for the dockworker. We have called, at the same time, for a chart for the future of projected methods changes. We have won only a faint response to these calls.

The cargo handling methods and practices—some new and some old—which continue to be a threat to the earnings and jobs of the men covered by ILA collective bargaining contracts, include the following, among others:

1. containerization of cargo,
2. preunitization of cargo by means of partially enclosed pallets and by means of open units or boards,
3. bulk loading for liquid products, semi-liquid products, and for any cargo that can be pulverized,
4. gluing of cartons and bags to one another to make up a single unit,
5. the use of steel strapping, nylon tape, twine, and steel wire to preunitize cargo on shipping line skids or on the shipper's or transporter's own lightweight pallets.
6. enclosing cargo in a cardboard or wood frame, or strapping it to a pallet or skid,
7. shipping liquid cargo in bulk in very large tanks carried on the deck of a vessel,
8. the use of rollers on trucks which move cargo to and from the piers,
9. the use of side port loaders,
10. unloading cargo from the tailboard of the truck onto skids by other than labor working under ILA contract, and
11. the use of one or more fork-lift trucks in the hold of the vessel.

Each of these shipping practices has a significant effect on the work time available to the dockworker. Each of these practices has yielded marked savings to the employer and marked losses to ILA labor.

No better proof of the adverse impact on the labor force and the favorable impact on the employer's costs is needed than an examination of ship turnaround data in the port of New York. Vessels that used to lie in port for 60 hours while unloading and loading cargo, now take from 8 to 20 hours. Prepalletization of incoming whisky cargo in the form of 1- to 2-ton units has cut turnaround on such vessels from 5 to 2 days of work. The side port loader can handle at least 35 drafts per hour, eliminating 4 to 6 hours per man from the hours used for handling cargo by conventional means.

The growing diversity of commodities which are being shipped in containers or in other preunitized forms is well illustrated by a sample of such items reported in a study made for the ILA. The following are either shipped in or out by preunitized means:

—whisky
—Coca-Cola concentrate
—canned transmission fluid
—cheese
—sheets of rubber
—Pepsi-Cola in drums
—canned fish
—mortar in bags
—tile
—television tubes
—reelstands
—canned tomatoes
—fiberglass rolls
—lumber
—wine in gallons
—film
—toys
—art materials
—electrical appliances
—rubber tires
—oil in drums
—mayonnaise
—flour in bags
—juke boxes
—canned pineapple
—glass tubing
—glass sheets
—steel wire in coils
—steel sinks
—paint
—electric meters
—powdered plastic in bags
—diced synthetic rubber in sacks
—recording tape
—rubber hose

And this is only a partial listing.

We have never raised general objections to the shipping industry's attempts to introduce cost-saving approaches to their operations. But we have objected and will continue to object to cost-cutting which is labor-discarding.

The protection we seek for the dockworker is no different in principle than the protection that has been built by the Federal Government into the operations of our shipping lines. The shipping lines receive Government subsidies which guarantee them a profit on capital used in subsidized operations. They are permitted tax-free reserves under their subsidy contracts. They get 100 percent mortgage insurance by the Government to make it cheaper for them to borrow money for converting existing vessels, or for building new container ships.

We of the ILA are not willing to stand by and watch the shipowners jump off to ever higher profits from the top of a mountain of unemployed dockworkers.

The shipping lines can enjoy ample cost-savings from containerization and preunitization alone without discarding one longshoreman or one man-hour of working time. Such cost-savings accrue through the following:

1. reduction of the costs from lost cargo,
2. reduction of the costs from damaged cargo,
3. reduction of the costs from detoured cargo,
4. reduction of the costs from stolen cargo,
5. reduction of the costs from repairs to cargo in transit,
6. reduction of the costs which arise from cargo deterioration in transit,
7. reduction of the costs of time lost in customs,
8. reduction of costs through the time saved in speedier turnaround of vessels,
9. reduction of costs through time saved by quicker discharge of the load at the port of destination,
10. reduction of the costs to the shipper of multiunit export packaging,
11. reduction of insurance costs, and
12. reduction of the costs of time spent in handling cargo documents and doing paper work.

The employers in the shipping industry have adopted a position which is traditional throughout industry in the United States. As their labor-discarding methods are introduced, they see opportunities for improving the wages and fringe benefits of those workers who are not discarded from the industry's labor force. Such an approach regards human beings as expendable. Too many employers regard labor as just another factor of production. It is an easy step from this view to that of treating the labor force in the same manner as industry treats obsolete industrial techniques and machines. This is the heart of the matter for the dockworker. We mean to continue to campaign against the treatment of dockworkers as expendables. We campaigned successfully in the past for protection against the hazards of industrial accident, the burdens of old age, and the risks of ordinary unemployment. In each instance Government acted to protect the worker on the grounds that such burdens are not properly heaped on the employee. These risks were, rather, additional employer costs of doing business.

We maintain that the unfavorable employment effects of changes in technology must come to be regarded as an added cost to the employer who puts such changes into effect. Business investment in new techniques must be broadened out to include any human costs that may be involved.

We believe that the Federal Government must take steps to cope with the technological displacement of labor force. Industry is not up to the task, and collective bargaining over the issues involved cannot produce lasting or satisfying results. A technologically displaced worker must be treated as a ward of the Government. Such a worker has invested all that he had to invest in his industry—his strength, his ability, and his years. All we ask is that this investment be treated with at least the same tender concern that money investments are treated in times of stress. Moreover, capital is movable, but the average dockworker's skills are not transferable. And, our statistics show that he is beyond the age when a man can be considered a good prospect for retraining for work of the type available in industrial activities which are growing.

Much of the attention of the ILA and the employers in the shipping industry has centered on the Port of New York. This does not mean that the other major East and Gulf Coast ports have developed job or income stability, or that they have met the problems arising out of changing methods with some happy solutions. The dockworker's job security is even shakier in some of our eastern ports than it is in New York.

In New York, there are about 24,000 longshoremen available for work, yet peak port needs on any 1 day are filled by no more than 19,000 longshoremen, and such peak days are unusual.

In Baltimore. there are less than 4.000 longshoremen available for work, but peak-day employment is about 2,800.

In Philadelphia, there are about 7,000 longshoremen, with only about 3,000 at work on a peak day.

In New Orleans, there are about 15,000 longshoremen, with peak-day employment at about 6,800.

And so it goes from port to port in Eastern United States. Furthermore, average daily employment of longshoremen is typically far below peak-day levels. The work is casual, and the hiring commitments are short. Longshoremen are employed for 4 hours at a time; this is the extent of the employer's commitment when he hires the dockworker. In much of American industry, the worker is hired by the week or the month. As a minimum, some industries hire workers by the day. Some even hire workers by the year. In the very shipping industry that hires longshoremen, the minimum employment of vessel personnel is on a voyage basis and at a monthly rate of pay.

The annual earnings of longshoremen highlight further the security problem confronting dockworkers. In the port of New York, dockworkers average about $5,000 a year, while in New Orleans they average about $2,000 a year. In Galveston, the average earnings are even lower. The hourly rate of pay is for all intents and purposes similar from port to port, but the hours of working time vary widely. Hence, the annual earnings vary widely.

So that there can be no misunderstanding of what the ILA regards to be inadequate consideration of the dockworkers' problems by the shipping industry, a summary of the key provisions pertaining to job security, cargo handling method changes, and flexible use of the work force in our October 1, 1964 to September 30, 1968 collective bargaining agreement is set forth below. We of the ILA do not intend to derogate the results of our best bargaining efforts to date. But neither we, nor anyone else, should exaggerate the significance of these results. We have not solved the dockworker's employment and income insecurities. We have simply been groping our way towards solutions with the best means at hand. It is simply the plain fact that the best means available at this date in our Nation's history are not good enough.

Some of the provisions of our new Port of New York contract provide:

1. A $125-per-month pension for employees retiring between April 1, 1965, and January 1, 1966. A $175-per-month pension beginning January 1, 1966, for retirements of employees who attain age 62 and have 25 years of service.
2. A disability retirement benefit, beginning January 1, 1966, of $125 per month for an employee at age 45 after 15 years of service, up to a maximum of $175 per month after 25 years of service.
3. Beginning April 1, 1966, employees with 700 or more hours of pay from April 1, 1965, to March 31, 1966, are guaranteed 1,600 hours of annual income in the contract year October 1 to September 30. Payments, up to 75 percent, of the guarantee are made after the first three-quarters of the contract year. Employees who are away from work and are receiving benefits under workmen's compensation, disability law, or the ILA and management Welfare Plan receive credit at the rate of 20 hours per week towards the 700 hours qualification. Gross earnings received by an employee in the income guarantee period are deducted from the income guarantee. If an employee fails to report for work when ordered out or if he fails to make himself available for work at 7:55 a.m. in the work section in which he is registered, he loses 8 hours of guaranteed income. A man who reports for work as ordered in an initial period but fails to return to work if reordered for the next period loses 4 hours of income guarantee. An employe who fails to make himself available for employment in accordance with the standards of the agreement can be disqualified from receiving the income guarantee.
4. As of April 1, 1966, the employer has the right to hire only the number of clerks, checkers, other crafts, and terminal labor as are necessary to perform the work.
5. All frozen details are eliminated.
6. Detail men, when ordered in, are assignable at the discretion of the employer to any other productive work within their craft jurisdiction.
7. When 250 regular checkers and clerks with valid seniority cards die, retire, or become permanently separated from the industry in the Port of New York, employers who wish to eliminate hatch checking may do so if they deem such checking unnecessary.
8. The employer has the right to distribute the members of the work gang to any assignment within the gang which they are qualified to perform.
9. Extra men added to a gang by the employer may be transferred from gang to gang as needed.
10. The employer may transfer gangs from hatch to hatch and ship to ship in a terminal, if the transfer does not displace another gang.
11. The contract standards for testing safety, health, and reasonable workloads on one or more employees are to be observed in making manpower shifts.
12. As of April 1, 1966, the employer has the right to drop two men from the minimum general cargo gang. And, as of April 1, 1967, one additional man is dropped from the gang.
13. The ILA and NYSA Human Relations and

Implementation Committee is authorized to work on means for improving borough, area, and portwide mobility of longshoremen.

14. The Human Relations Committee is authorized to work out a system of penalties for absenteeism and tardiness.

15. The existing seniority provisions are to be reviewed so as to produce changes facilitating portwide availability of longshoremen.

16. The employers have pledged to join the ILA in efforts to close the Waterfront Commission's employment register.

17. A Management-Labor Employment Cooperation Committee has been formed to effectuate contract provisions relating to availability of labor, work force mobility, stability of work opportunity and earnings, control of tardiness and absenteeism, procedures for closing the employment register, and arrangements for having ILA representatives at Waterfront Commission Hiring Centers to monitor hiring and assure carrying out the income guarantee provided under the contract.

18. In addition, wages are to be increased by 36 cents an hour, employer pension contributions by 24 cents an hour, Welfare Fund contributions by 5 cents an hour, and Medical and Clinical Services Fund contributions by 3 cents an hour over the 4-year duration of the contract.

To those who are not intimately involved or acquainted with the longshoremen's job and income problems these few advances spelled out above may appear to be impressive. We of the ILA who have struggled to produce these few gains have found in them no cause for complacency.

To those who are not intimately involved or acquainted with the managements who constitute the longshoremen's employers it may seem that they have been willing partners in a program for coping with their dockworkers' problems. This is far from true. We have inched along the road towards dockworker security, pulling the dead weight of unenlightened management behind us.

We face the prospect today of having a hard-won guarantee of an income minimum for the dockworker become his income maximum.

Our problem as a nation may be that industry grabs too recklessly at opportunities for technological change. We commend to the Federal Government the view along these lines expressed by Professor Walter L. Eisenberg, chairman of the department of economics, Hunter College of the City University of New York, a leading expert on the effects of automation on the work force. He puts part of the matter in these words:

> Not all technological change deserves to be described as technological progress. The history of industrial development in the United States warrants the conclusion that the very quest for technological improvement has been institutionalized. Our industries have made a fetish of changing machine technology and the methods for organizing and distributing production. Consideration should be given to the possibility that an imaginative estimate of net social gains accruing from a specific change in technology would show zero or negative results. The impression that grows out of study of the increasingly inflexible skill, experience, and other characteristics of the labor inputs into production is that there are substantial social cost-offsets to the specific cost-reductions that may accompany particular changes in industrial technology. Our economic analysis of the consequences of technological changes may be too narrow in conception. A more comprehensive accounting of consequences may reveal that numbered among the technological "improvements" are changes that produced merely different, rather than better, ways of producing some of the Nation's output of goods and services. If a particular firm's or industry's gains from a change in operational techniques are more than matched by losses incurred by the labor force, or by other industries, or by consumers as a direct or derived result of such changes, then innovations of techniques which are simply changes must be carefully distinguished from the concept of technological progress. "Progress" is a value judgment which has been too loosely applied to the industrial manifestations of the genius of laboratory scientists and engineers. An enlightened society should indeed foster broadly based economic advances through technological progress. It should not, however, stand ready to underwrite blindly the price of change for change's sake.

Professor Eisenberg's views cut to the root of our concern over methods changes in the shipping industry. A sound evaluation of new cargo handling methods may well show that the shipping and other industries' profits from these new methods are overshadowed by worker and other losses. Perhaps such methods changes should be blocked.

We hope that Government will address itself to this concern with imagination and boldness. If it does not, the dockworker and many another worker in American industry face a dismal, troubled, and turbulent future.

STATEMENT

Prepared for the Commission
by the
International Union of Mine, Mill, and Smelter Workers
Denver, Colorado

Statement by the International Union of Mine, Mill, and Smelter Workers

The Commission, in dealing with the definition of unmet community and human needs toward which the application of new technologies might most effectively be directed, and the assessment of the most effective means for channeling new technologies into promising directions, can only point the way to an acceleration of the process which is already creating employment problems with which our society—unions, companies, government—is seemingly unable to cope in adequate fashion.

We can only cope with these problems by a drastic lifting of our sights in several major areas, and it is on this that we wish to concentrate our statement.

First of all, our rich society—the wealthiest civilization has ever known—is poor in many vital respects. We have many needs as yet unmet which, if met, would entail massive public and private construction projects. We have in mind here the tearing down of all substandard housing, urban and rural, and its replacement with housing which we can easily provide with the human and material resources our society commands, the overhaul and rebuilding of our obsolete and rundown public transportation facilities, a long range attack on the water problems of the arid West and increasingly water-short Northeast, a reversal of the pollution of our streams, rivers, and lakes, and provision of a host of public facilities in the form of schools, hospitals, parks, and the like. You will appreciate that this catalogue is not complete, merely illustrative. We are moving in all of these areas, but too slowly, and too unimaginatively. We believe the Commission can make a great contribution toward lifting our sights by setting forth, in monetary terms, a program of investment in these and other types of projects that will be of a completely new order of magnitude, but one within the capabilities of our economy mobilized to achieve a better life for all.

Such a program would for many years provide enough jobs to remove the threat of mass unemployment that faces us in the next decade. It would ease the tensions which, as President Johnson has said, will otherwise inevitably bring us repeated outbursts, like the Los Angeles riots which shocked the Nation. It would ease the pressure of unemployment on wage and earning standards of the unorganized in the service and other low-wage industries, and of the self-employed in small business and uneconomically small farming operation. It would meet the employment needs of the millions of young people who will soon be in the labor market. It would buy us time in which to plan for a better social order 20 or 30 years from now.

Ultimately, as such writers as Robert Theobald and Richard Heilbroner (Fund for the Republic and the Ad Hoc Committee on the Triple Revolution) have cogently demonstrated, we will be faced with a situation in which our productive economy will be unable to provide jobs for a large proportion of our adult citizenry, and where a living will have to be provided for large numbers of people from sources other than earnings. We can look forward with anticipation to the continued contribution which automation and technological change will make to the elimination of dull, heavy, and repetitive work such as still characterizes much industrial employment. But the satisfactions which ensue from secure employment in work which is intrinsically challenging—work which places demands on human intelligence and capability—should be husbanded and equitably shared.

As we move into an era where employment requirements will inevitably diminish, we need to plan most intelligently for a balanced sharing of employment and growing opportunities for leisure. We can only sketch the broad outlines of a comprehensive approach to this problem—one which would include earlier retirement, adequately provided for, an extension beyond high school of the education and training of all of our young people, a shortening of the standard workweek, and much more extended periods of vacation than are now available to most of our working population. By moving progressively in these directions, we can extend for many years into the future the opportunity of employment for all of our citizens during the most productive years of their lives. At the same time, a better educated population can be prepared for a more satisfactory enjoyment of the leisure which shorter hours, longer vacations, and earlier retirement will provide. Ultimately, with further technological progress, we must prepare many of our citizens for self-fulfillment without employment in the traditional sense of productive work. We hope that this stage can be postponed through the approach outlined, in the interest of a gradual and planned transition to a way of life for which many of our citizens would now be unprepared.

In closing, we wish to express the conviction that the objectives sketched here, and with which hopefully the Commission will broadly concur, can only be achieved as they emerge from the workings of an informed and understanding democratic process. We concur in the statement which appears at the conclusion of *The Triple Revolution* issued by the Ad Hoc Committee on the Triple Revolution: "Democracy can only be rooted in a political and economic order in which wealth is distributed by and for the people, and used for the widest social benefit." Our organization welcomes the growing democratization of our society—the enfranchisement of our Negro population and other minority groups; their growing political awareness; the Supreme Court's landmark decision removing the hobbles with which rural minorities too long have fettered our State legislatures; and the growing public awareness of our economic problems as manifested by the domestic legislative record written by the 89th Congress. Our union awaits the report of the Commission as an important contribution to an even better understanding by our democratic society of the hope and the challenge which modern technology presents.

STATEMENT

Prepared for the Commission
by the
John Hancock Mutual Life Insurance Company
Boston, Massachusetts

Statement by the John Hancock Mutual Life Insurance Company

Some general comments concerning three of the five parts in the Commission's charge follow. You will appreciate, of course, that they pertain primarily to the insurance industry—the only industry whose technology is thoroughly familiar to the writer.

1. Large-scale data processing machines have been in use at the John Hancock since 1955. The original equipment is still in use, but it has been augmented gradually by more advanced machines. It seems clear that the rate of technological change is accelerating and an increasing challenge is presented to use most effectively the tools at our disposal.

As with most early users of computing equipment, this company first converted routine, repetitive accounting functions from manual or electromechanical to electronic processing methods. Only recently has our attention turned to the more demanding area of management information systems.

The number of employees in the home office has shown a gradual increase, from 5,143 in 1955 to 5,475 in 1965. A noticeable upgrading of jobs has occurred during this period as repetitive tasks have decreased and systems and programing work have grown in scope.

2. The future lines of development in electronic data processing seem to be clearly indicated by the events of the last 10 years. Electronic installations can be expected to grow in both size and number as the cost of computing hardware is reduced. System complexity will increase sharply and there will be a growing demand for systems engineers versed in computing and communications techniques.

We anticipate a growing emphasis on computer understanding in secondary schools and universities. Through advances in modular programing techniques and universal languages such as COBOL, use of the computer as a data processing tool will be within the reach of a growing number of people. First attempts at time sharing, such as MIT's project MAC, can be expected to expand to much larger proportions.

3. Within the insurance industry, the major unmet community and human needs we see arise from the wholly inadequate insurance program of the average U.S. citizen. In part by use of electronic computers, we anticipate freeing our field forces from the routine clerical tasks of premium collection, accounting, etc. Their full time can then be devoted to carrying the insurance message to the American public.

STATEMENT

Prepared for the Commission
by the
Raymond H. Kahn, M.D.
University of Michigan
Ann Arbor, Michigan

Statement by Dr. Raymond Kahn, University of Michigan, Ann Arbor

I shall try to set down a few general statements in the hope that they will be of some assistance.

a) The Commission and Congress are undoubtedly fully aware of the past and current effects of technological change on our society. What has evolved in the last 20 years would have stretched the imagination of any prognosticator of the future. In the area of biology, we have leaped from a purely taxonomic science to what can best be described as a basic and applied science. We have seen within our lifetime the development of a vast array of antibiotics too numerous to mention, systems of vaccination against dreaded diseases, skills in surgery so profound they would not have been considered possible 20 years ago. More importantly, the basic findings coming out almost daily prophesize that we are on the verge of many more discoveries and advances. The cause and treatment of cancer, in all its many forms, are on the brink of being resolved; the ability to replace diseased organs with healthy ones is almost a reality; for the first time we are learning about congenital diseases and their causes; mental disease and its treatment is slowly becoming a science and not just an art. These advances are not surprising when one realizes that we now have on earth more living scientists that ever existed in all recorded history of man. Furthermore, present data would suggest that this figure will double by the year 1980.

b) With this revolution in technological change, it is self-evident that the next 10 years must be years of educating and communicating these changes to society and specifically to our younger people. The blue-collar worker and to some extent the white-collar worker are already in less demand, while jobs requiring technically trained personnel go begging. For example, there are now over 200 budgeted vacancies for anatomists in the United States, and with the advent of more medical and dental schools, the demand will be increased.

c) Thus, our society and specifically the State and Federal Governments must resolve the problems of education and communication.

In the area of education, the basic question we must face is whether or not education, at all levels, is a luxury, a privilege, and an investment which is solely the responsibility of the recipient, or a service to society which society should be willing to pay for. I would take the latter stand and suggest that the Federal and State Governments must increase their important role in the training of teachers, scientists, and students. Programs such as the Health Professions Assistance Act, the National Defense Education Act, and United States Public Health Service grants and awards must be augmented and expanded to include all intellectual levels of our society. We need more physicians, but we need more medical technicians as well.

As far as communication is concerned, man's ability to follow our technical progress is hampered by the sheer mass of material published. It is becoming practically impossible to follow the literature, and the problem will get worse rather than better. The Federal and State Governments must continue to investigate ways and means of disseminating information. The MEDLARS system, currently supported by the Federal Government, is a small beginning in the area of medical literature which should be fostered and expanded to other areas of technical need.

d) With the increased availability of education to all members of society and with mechanisms for communicating new advances, the civilian industries will reap benefits and, in turn, benefit society.

e) Thus, government at all levels must:

1) make education a responsibility of society in general by lowering tuition to trade schools, community and junior colleges, as well as universities, rather than raising them as is the present trend; provide more scholarships to deserving students at all levels of academic endeavor; foster the training of teachers by making a career in teaching an honorable, lucrative, and esteemed one;

2) continue to promote scientific achievement by stipend, scholarship, and grants. However, such support should be tied to a teaching role as well. In other words, I believe the scientist must be obligated to teach his findings rather than expect others to do it for him;
3) instigate mechanisms for exchange of information utilizing modern computer methods at all levels of technical interest.

STATEMENT

Prepared for the Commission
by the
Lockheed Aircraft Corporation
Burbank, California

Statement by the Lockheed Aircraft Corporation

Permeating a number of the points set out in the Commission's mandate is the thought that technological change can potentially harm the Nation's economy. We believe that it will be important to reshape the tone of these points to stress the view that technological change is vital to the continued growth of the economy, as well as to improvement of our standard of living. Permit us to cite the experience of the aerospace industry in this regard.

In its early days, the aerospace industry built planes made from bits of wood and cloth. These planes were slow and had limited usefulness. Then designs were evolved that made extensive use of metals and new propulsion systems were employed. Now the industry is on the verge of making the transition from the employment of soft metal (aluminum) to hard metals (stainless steel and titanium), and even more advanced propulsion systems will be used. Paralleling these changes in technology, whole new industries have been spawned to implement the new designs. Examples of new industry abound in the subsystems areas, such as suppliers of cooling equipment, auxiliary power supplies, and avionics manufacturers.

An even more outstanding example of the creation of new industry stemming from the exploitation of new technology is to be found in the missile and space vehicle portion of the aerospace industry. Here again, the effect has been to nurture the growth of new support industries in parallel with the growth of the vehicle manufacturers. Attendant to these developments has been the creation of thousands of new jobs throughout the Nation.

Relating to defining unmet community and human needs, we shall cite a number of pressing needs without proposing solutions, recognizing that the Commission can relate proposed actions to these needs. In brief, outstanding community and human needs that should be treated are:

a. Reinforced activities to reduce air and water pollution in urban areas.

b. Accomplish research related to the growing geriatrics problem. In particular, research that seeks treatments for the illnesses unique to the aged, as well as research that is aimed at maintaining vigor in the aged, is urgently needed.

c. Developing solutions to the problem of providing satisfactory low-cost housing requires both political action and technological development.

Regarding the proper relationship between governmental and private investment in the application of new technologies to large-scale human and community needs, not infrequently the introduction of new technology for stated purposes requires Federal Government action before significant technological progress can be realized. This is either because the new technology is concerned with projects that are too costly for private industry to afford, or political considerations render industrial activity unattractive. Examples where new technology can be too costly for private industry are giant civil engineering projects spurring the introduction of nuclear power into the civilian economy, and the development of high-cost, highly sophisticated aerospace vehicles. Examples of where the introduction of new technology lags because of political constraints are air and water pollution and new forms of housing, the latter due in large measure to archaic building codes. In these situations, the Federal Government can properly assume a position of leadership with private industry expected to assume a growing degree of involvement as rapidly as the financial risks are reduced to reasonable levels or as political constraints are set aside.

With relation to adopting measures which will facilitate occupational adjustment and geographic mobility of workers, it is our firm belief that most of the major corporations in the United States have seen fit to diversify their organizations geographically for a variety of sound business reasons. This characteristic of our free enterprise system can be counted on in the future to solve many of the problems implicit in this point. For example, the Lockheed Aircraft Corporation has diversified from a single division located in California to 9 divisions with activities in 10 states within the span of a single decade. Related to this point also, the current efforts by the Administration to improve the economy of the Appalachian region comprise excellent governmental actions to attract industry to a new geographic region.

STATEMENT

Prepared for the Commission
by
P. R. Mallory & Co., Inc.
Indianapolis, Indiana

Statement by P. R. Mallory & Co., Inc.

For the past few years, and for an indefinite time in the future, we have been and will be living through a technological revolution said by some to be greater than the industrial revolution of the 19th century. We agree with this statement. In the near and immediate future, it will be necessary for some areas of technology to catch up with, and complement, other areas where progress has been greater.

The technological improvements referred to above will necessarily result in worker displacement during the next 10 years. On the other hand, with the economy growing there will be more job opportunities. In view of the expected greater leisure time and greater economic resources to our population, a shift will occur in employment to the leisure time and service industries. There will be an increasing necessity for educating the worker, both the wage earner and salaried worker. In the area of technology, there must be a shift to greater understanding of materials and further medical research. There will be a greater shift to urban communities, and especially to the megalopolises.

The most effective application of new technologies, including those supported by the Federal Government, for meeting unmet community and human needs would be in the area of medicine.

The most effective means for channeling new technologies into promising directions is for the Government to encourage greater profit incentive to industries. One method might be to give additional relief in taxes for research in technologies which are considered to be the most beneficial for the Nation. This approach has been initiated in several countries, including Canada.

In order to facilitate occupational adjustment and alleviate the adverse impact of change on displaced workers coming from the necessity to adjust occupations, greater education and better education is necessary. Consequently, Federal and local governments should give consideration to deductions for tax purposes of a part or all of educational costs, provided the education meets certain standards which are established to promote the public welfare.

STATEMENT

Prepared for the Commission
by
McGraw-Hill, Inc.
New York, New York

Statement by McGraw-Hill, Inc.

The issues to be studied by the Commission are of great national importance and worthy of careful and thoughtful investigation. Because of our concern for sound and rapid economic growth, and our particular interest in all types of education and training, we at McGraw-Hill strongly endorse your efforts to increase understanding of these issues.

In the light of some of the hysterical pronouncements and exaggerated fears of "automation," it is heartening to look forward to the objective approach which is made possible through the establishment of the Commission.

Much current discussion of this subject lacks historical perspective and magnifies unduly the economic dislocation associated with technological change. In the first place, it should be recognized that recent technological advances do not represent an abrupt break with history but rather a continuation of the steady stream of discoveries, improvements, inventions, and new techniques which have affected economic life, particularly since the industrial revolution of the 18th century. It is true that technological change is cumulative and thus has a progressively greater impact over time, but this very cumulation rules out the notion that automation is a phenomenon peculiar to our particular day. The great scientific achievements of modern times are thus part of the long sweep of man's growing understanding of the universe.

In the second place, practical considerations impose a moderation and a regularity in the pace at which technological change enters the economic system. It is a long way from the first controlled atomic chain reaction to widespread economic generation of electric power by nuclear reactors. Existing plant and equipment cannot be scrapped overnight even after practical applications have been developed from initial scientific discoveries. Financial considerations also impose limitations on the ability of corporations to innovate. Consumer markets adapt to new products only with a considerable lag. Although our economy is noted for its dynamism and flexibility, even in so responsive a system change necessarily evolves at a fairly moderate pace.

In the third place, data on the rate of productivity improvement in the United States show quite clearly that there has been no really marked escalation in the rate of technological change over a long period of time. Output per man-hour can change because of forces other than the introduction of machinery, but certainly a marked escalation in the rate of technological change would be reflected in a marked escalation in output per man-hour, and there has in fact been no such marked change in productivity growth.

In the fourth place, the low level of current unemployment rates demonstrates the invalidity of the hysterical notion that the machine is about to throw us all out of work. Since 1961, plant and equipment expenditures have risen steadily and substantially, yet during this same period the unemployment rate of experienced wage and salary workers has declined steadily and substantially and is now almost down to the low level of early 1957—this despite the fact that the average workweek in manufacturing, which in the long run has shown a pronounced shortening, is today higher than in 1957.

If, then, it is a mistake to suppose that we are faced with a crisis because of advancing technology, does this mean that technological change poses no problem? Not at all. Change always brings temporary dislocation which for some business concerns and some individuals can produce distressing effects. The solution is not to be found, however, in going back to the horse and buggy but in improving the ability of society to adjust to and capitalize on this change. The primary need here is the development of better systems for education and training of the labor force, as well as private and Government programs designed to facilitate the mobility of labor and ease the problems—financial and other—of transition from one job or technique to another. We need not add that a prosperous and rapidly growing economy is a necessary prerequisite to these transitions and adjustments.

At McGraw-Hill we are devoting vigorous efforts to the development of job training systems and to the improvement of textbooks, audiovisual aids, and new and more effective educational means. Education is the basic key to many of the issues under consideration by the Commission.

STATEMENT

Prepared for the Commission
by the
Metropolitan Life Insurance Company
New York, New York

Statement by the Metropolitan Life Insurance Company

Role and Pace of Technological Change

Both the long-term trend away from farm employment to nonagricultural business and industry, and the more recent employment shifts from the goods-producing industries to the service lines, resulted in large part from the technological progress of past years. As these fundamental transitions were developing, overall employment expanded generally except during business recessions, indicating a basic ability of the U.S. economy to absorb workers displaced by technology. As strong evidence of this, new plant and equipment expenditures by business in the United States have climbed from $20 billion a year in 1950 to an expected $50 billion in 1965, and during this period some 13 million new jobs have been added in the U.S. economy.

In fact, it would be very helpful if the users of unemployment data would focus more of their attention on the low unemployment rate among married men at 2.4 percent, instead of only the average rate for all workers at 4.7 percent (as of this writing), and if at least equally ample data were available on job vacancies and forward planning for employment.

Although automation has been developing for years, the type most often discussed may be in its early stages—computerization, cybernetics, etc., possibly leading to a reorientation of our business and industrial structure. There is, of course, a limit on the degree to which business and industry is adaptable to automated processes. Various lines of activity are very differently suited to the introduction of intensive automation.

New industries producing new products may be heavily automated at their inception. However, there is more concern now with the transition of established industry to more automated operation. The time required for such transition is both costly and beneficial. The cost element is obvious—the beneficial aspect of the slow pace perhaps less so. The comparatively long time between the first steps toward automation of a process and actual installation and full functioning allows time for attrition, for each firm's own planning regarding internal shifts of the current labor force, and for any other type of preparation which might be devised and tailored to a particular industry or business. Much of the current discussion has been stimulated by the actual installations, and little attention is paid to the necessary planning period.

As one illustration, the Metropolitan Life Insurance Company, one of the Nation's largest companies, is a major user of electronics equipment for data processing. We were pioneers in the use of large-scale computers in offices, having a major operation installed and fully processed by a computer as early as 1955. Our use of automatic data processing equipment has grown steadily through the years, and we now have in operation 30 electronic computers handling a wide variety of clerical operations. While this experience does not qualify us to forecast the possible effects on the whole economy and structure of the Nation, it nevertheless enables us to offer such opinions as can be derived from our own 10 years of development, experimentation, and use of automatic data processing equipment.

The obvious social benefits of these technological improvements in the insurance business are the contribution which they can make toward lowering costs and providing the public with more protection for their money, and the improvement in quality of service to our 45 million policyholders.

Impact of Technological Change and Unmet Needs

Owing to the high level of economic activity and to the relatively slow pace of progress, the results of automation in industry so far have been reasonably orderly, even with changing job requirements over recent years. It is only natural to expect that a prosperous economy can better accommodate workers displaced by technology than can an economy in which these workers are competing with more numerous others, unemployed for different reasons.

Industries and occupations most affected by automation, both in the past and in the years to come, are those involving easily definable repetitive procedures and processes, either mechanical or clerical. Geographically speaking, it is difficult to pinpoint an area or areas in which automation might be an overriding factor. With the exception of the fixed location of natural resources and the mechanizing of their extraction, geography in itself is not usually significant.

A recent study by the Bureau of Labor Statistics on technological trends in selected major American industries revealed that technological changes presently in view would probably bring reductions in employment in 1970 in some 18 of the industries surveyed, while growing demand in 14 other industries is expected to result in increased employment along with technological improvements. It is significant that these latter 14 industries, which included insurance, accounted for two-thirds of the employees in all the industries surveyed.

It is recognized that specific individuals may suffer from automation. Some workers may lose jobs (although *not* at Metropolitan) and some firms may lose markets as a result of rapid obsolescence and other factors. But not all automated processes have the same effect. Some will eliminate jobs, while others will require more labor. Moreover, advancing technology creates new and better jobs and broadens markets. Needless to elaborate, there can be no direct balance between these pluses and minuses. Investment in education, at all levels, emerges as a very important tool. This is necessary all along the line, from vocational training and on-the-job training in a specific business to the attainment of university degrees.

An account in somewhat more detail of Metropolitan's experience in the mechanization of office work may be of interest to the Commission. Metropolitan was a pioneer in the use of punched card equipment, in the introduction of management controls, such as work measurement, in functionalized work assignments, and in other now familiar devices used to lessen the cost of recordkeeping and data processing and to adapt the company's requirements to the increasing number of young people, particularly young women, who sought a rather simple clerical job at the beginning of their careers, but who did not expect, with any certainty, to continue clerical work for the full length of their lives.

We introduced general purpose electronic digital computers into our record processing in 1954, and after 5 years' experience came to the conclusion that we should press ahead with the application of the new means of recordkeeping and data processing as fast as we could.

One of the first steps taken following the placing of the purchase order for our first major computer in 1953 was to explore as thoroughly as possible the effects which automation would have on our organization, employment, job requirements, etc. Policy was developed and published for the guidance of our executives which, in summary, provided (a) for keeping our employees fully informed as far in advance as possible of the projected changes, and (b) for assuring all concerned that no employees were to be terminated, laid off temporarily, downgraded, or suffer reductions in salary because of technological changes. The company would undertake to retrain, where necessary, and transfer displaced employees to other positions of a comparable character wherever possible, but in any event transfer them to a useful position. Double displacements would be avoided and other steps taken to eliminate or reduce as far as possible any adverse effects on our employees. This policy has been scrupulously carried out despite extensive new applications of automatic data processing over the past 10 years. It has been facilitated by a policy of "recruiting from within," and employee development and promotion.

Like many other companies feeling the effects of the low birth rates in the 1930's, we had for 20 years (or since the early 1940's) experienced severe difficulties in attracting and retaining adequate clerical help to do the necessarily tedious jobs which some of our procedures involved—processing new policies, premium notices, receipts, claims processing, and routine correspondence and notifications. The transition to automatic data processing, where it has been applied, has been effected without any involuntary separations from our payrolls. This has been a matter of policy as well as of fact.

As has been the case elsewhere, Metropolitan has found that employee displacement has not occurred nearly as rapidly as was forecast. As a matter of fact, normal attrition from resignations, deaths, retirements, etc., far exceeded the number of employees offset by automation. Our primary task was, therefore, not one involving numbers of people, but rather the reassignment and retraining of such employees as were displaced. Automation only added in a rather minor way to the process of training and retraining already familiar to us because of attrition and promotions.

Another pertinent factor has been our burgeoning national economy. Our own business has grown and expanded apace with it and is expected to continue to grow in the future. While electronics has helped up to handle this increased volume, the growth of our business has also helped us to place available employees in suitable vacancies in different units.

Our objective in utilizing modern electronic automatic equipment is to enable us to provide better service to our 45 million policyholders at a reduced operating cost. Savings in clerical and administrative costs are of direct benefit to our policyholders and help us to provide them with insurance protection at favorable rates. Lower costs benefit millions of families.

The overall effect on the composition of jobs in those areas where computers have been applied has been to reduce the routine, repetitive, and monotonous types of work and to increase the more technical, creative, and challenging positions. In our particular case, there has also been a reduction in certain types of semimanual skills, such as typing, although this has been partially offset by increases in the number of key punch operators. At the same time, there has been a marked increase in the number of people directly engaged in electronics operations, such as programers, computer operators, auxiliary machine operators, tape librarians, etc. We would expect this trend to continue. We are currently developing and installing a direct wire computer hookup between our home office and some 900 district offices, which will further accelerate this trend.

On the whole, it would seem that the problems, and possible problems, have been magnified and given more adverse publicity than they deserve. In May of this year, Governor Nelson A. Rockefeller released a summary of a report of the Advisory Committee on the Impact of Automation. The committee noted that there have been problems of employee displacement, but most of these have been met. It likewise noted a number of other rather favorable developments which are, on the whole, consistent with our own experience. The committee report has many items which are very pertinent to the Commission's studies.

Automation has and will continue to have an impact upon office employment; but while extensive readjustments may be required, we see no need, on the basis of our own experience, to view the situation with alarm. Automation would appear to represent an opportunity—another step forward in the technology which has produced our abundant economy. Already it would appear that such displacements as have occurred in the office are being absorbed in other services, and that such displacements have not occurred at a rate which is beyond the capacity of the economy to absorb.

Of course, even in Metropolitan we have not gone as fast as we would have liked, for a wide variety of reasons. We have, however, made very considerable progress although we would hesitate to say just how many more clerks we would have in the absence of computers (or for that matter, without electronic accounting machines, desk calculators, adding machines, typewriters, etc.), since there have been too many other changes in our operations for us to spend time making any detailed study as to what we would be doing if we did not have the machines. However, the savings that have supported the cost of equipment and of development work have come mainly in the elimination of clerical jobs at the beginning levels where there is normally a rather high turnover rate ranging from 20 to 40 percent per annum, mostly for reasons of marriage, family circumstances, or promotion (normally rapid at the lower levels), which last plays an important part under our personnel policies.

We would like to emphasize that where human effort has been replaced by machine processes, at no time has the annual rate of replacement approached the annual rate of attrition at the beginning levels, from promotion and resignation. We doubt that the average annual machine replacement rate has been as large as 10 percent of the annual turnover rate at the job levels primarily affected. This means that the machine replacement rate by number of jobs has probably been less than 1 percent of the total number employed by the company and has not come anywhere near the annual rate of growth in the business.

While we expect that during the next 2 or 3 years we will have a temporary bulge in the rate at which machine processes will replace clerical efforts at the lower job levels, the conclusion that can be drawn from past experience is that the rate of company growth will probably continue to exceed the annual rate of replacement of human effort by mechanical effort, although there may be short periods measured in months, the culmination of several years' development work, where the reverse may temporarily be the case.

Metropolitan has not discharged anyone, reduced his salary, or laid off anyone temporarily because of mechanization of clerical work, and has no intention of doing so. While the number of jobs at lower levels in future years will be less than it would have been in the absence of mechanization, we think the opportunities at higher levels will be greater, as well as more numerous, than they have been. All this has been true with respect to introduction of office machines in the past and we expect that it will hold for the indefinite future.

What has been said with respect to the "mechanical replacement rate" in comparison with the annual growth rate of the business should not be interpreted as necessarily meaning that the total number of clerical jobs at Metropolitan will or will not increase in absolute number in the future. For a complex of reasons—mechanization, changing business mix, new methods and systems, etc.—we believe that the productivity of the clerical force will continue to grow, and that it is conceivable that in some years the coinciding impact of all these factors may result in an actual reduction in the clerical force (by attrition). However, we also believe that there will be other periods when growth in number of clerical jobs will continue, although not at as rapid a pace as the growth of the business.

We would like to urge that the Commission in its studies not overlook other factors in increased productivity which may be as important or perhaps more important than automation or advancing machine technologies. Increased effectiveness of human effort, through modification of systems and procedures, change in mix of products, lowered overhead unit costs due to increased volume, and increased familiarity of people with their tasks because of continuing stability of employment, have all been substantial factors affecting clerical productivity at Metropolitan.

We think that this increased productivity will undoubtedly contribute significantly in the long run to reducing the cost of insurance for our policyholders, since Metropolitan is a mutual company.

Although we have not made any survey of the situation in the life insurance industry as a whole, and there is a very considerable range of experience among life insurance companies as to rate of progress with mechanization, depending on the complexity of the problem faced and the extent to which they can take advantage of the experience of others, we would suspect that the same thing would be true for our whole industry.

It must be borne in mind that when we are speaking of clerical work or paperwork—recordkeeping and data processing—we are talking about matters that are the primary concern of about one-third of the people employed by the life insurance business. But only a third of these—or approximately 10 percent of total employment in the entire life insurance business—is directly affected by mechanization of paperwork in the sense that these jobs are a probable target for replacement by machine effort.

The remaining two-thirds of the people in the life insurance business are employed directly in selling or servicing policyholders out of local offices; that is, branch or district offices, or in professional and technical fields. The effect of mechanization appears likely to free this latter two-thirds—especially the sales force—from the presently necessary paperwork chore that can be an impediment to their main activities. To the extent that they can take advantage of this increased freedom to do a more effective job, the cost of insurance should be reduced indirectly, just as it will be reduced directly by the mechanization of paperwork; and the product—service to policyholders and public—will be improved. So it seems likely that the direct impact of mechanization on employment opportunities in the insurance business will be proportionately very small, overall, even though in certain narrow areas it may be relatively large in the long run, though slow in emerging.

We should like to paraphrase in this connection a comment made by Charles E. Silberman in a recent article in *Fortune* magazine, to the effect that in speaking of automation we must distinguish between what is technically possible and what is economically practical. It seems to us that the implied restraint is one of the reasons for the rather slow pace of the broad spectrum of activities that is sometimes referred to as "automation" and for its relatively narrow fields of impact.

Another point made by Mr. Silberman that seems to have a general bearing on the prospective roles played by people and machines and on the impact of technological change is that while machines have been developed that are very ingenious in processing information, in forming and shaping materials, and in fetching and carrying things, they are not very good in seeing what is going on around them, particularly in seeing what needs to be done and in seeing new situations and new ways to handle things. I would not want to underrate the numerous advances in mechanical perception of color, temperature, pressure, etc., or the progress that has been made with electronic character reading, nor underrate the prospect of future advances. But the fact is that people are preeminent at the job of seeing what is new and what is wanted; we believe that will continue to be so for a long time to come.

It seems that the planning and design, the exposition and argument, the perception and analysis that are involved in selling, in control of business activities, and in day-to-day relations between a business and its individual customers (not to mention a government and its citizens), are likely to be increased in the future and that this expansion will be intimately related to a continued rise in the standard of living through the country. All of these activities will demand more and more manpower.

Channeling New Technologies

In developing effective means for channeling new technologies into promising directions, it is important that a favorable climate for vigorous business investment be sustained. Such goals as a successful war against poverty and the provision of remunerative jobs for an expanding population cannot succeed indefinitely by massive public works and artificial stimuli. Jobs will only materialize where business and industry are investing to their own and the economy's best advantage, and where training is selective and related to real demand.

Capital investment in plants and machinery is the major factor in economic growth and in general prosperity. Industries which obtain or generate investment capital and put it into modern automated equipment make better products at lower prices. Increase in demand for these lower-priced goods creates a need again for additional employees to distribute and service them. Similarly, as complex new equipment becomes more prevalent, the demand for better paid repair and maintenance personnel increases.

Government Responsibility

It cannot be too strongly emphasized that a prosperous private economy is essential not only for its own sake, but also to provide a cushion for the dislocations which are bound to take place as technical advance continues and public demands change and expand. Preparing people for a future, however changed under new technologies, cannot be achieved by any wholesale giveaway programs—whether sponsored by government or conceived on some other basis. The beneficial consequences of automation can be attained only by adopting sound economic policies.

The rapidity of advances in automation does not change the fact that profits make investment and investment makes jobs—now or in the future. For business to invest at an optimum level, it is necessary to guard against an inflation in the general price structure. In addition to the application of sound fiscal and monetary policies, inflationary pressures can be combatted by continued and appreciable growth of productivity in our economy. By using more and better plant and equipment and by training and utilizing labor in ways that increase output in services as well as goods-producing lines, it should be possible to arrive at lower costs per unit of output on a wide scale. Investment will create jobs if the means to do so is not consumed by extravagant demands upon business and industry or siphoned off by heavy taxes or inflation.

In regard to the actual use of plant and equipment, it must be recognized that a consequence of reduced hours of work has been some loss of efficiency. As an illustration, a 36-hour week for a large life insurance company's clerks means that a rather substantial amount of real estate, furniture, and equipment is being used only 36/168ths of the time. Since most of the objects represented by this investment go out of use by obsolescence rather than by wearing out, the more intensive use through a different mode of operation would contribute to a higher standard of living through lower unit costs. In theory, this might be done by shift operations, which are a familiar aspect of the manufacturing field. However, the social habits of our people are so strong and the difficulties of organizing shift work so great that, with the exception of some banks, very little has been done so far as we know by any large institution. Incentives to the institution itself are not sufficiently great to overcome inertia of tradition.

We want to acknowledge that in the field of computers and data processing, much of what has been accomplished in the last two decades would have been impossible without pioneering and development work financed by the Federal Government. Many of the things that have been done would have appeared economically impractical to even the larger business units, and governmental interest in this field has, we feel sure, tended to reduce costs indirectly.

We believe it follows from this that a rather widespread impression is correct—namely, that the larger the economic unit, the lower unit costs are likely to be, and that the larger units do in fact contribute materially to economic progress and to the rise in standard of living, not merely by lowering unit costs, but by being able to finance development work that can later be used in many cases by smaller competing businesses.

Over a long period, government at all levels has come to play a more active role in the economic life of individuals and businesses, usually by laws and regulations directed at specific economic symptoms thought to be undesirable. In some cases, the impact of these extensions has come to be much greater than originally contemplated, because of changes in the framework arising from technological advances, population redistribution, etc., or because of an increasing body of interpretation sometimes influenced by new circumstances and sometimes a too literal or too imaginative refinement of interpretation.

The multiplicity of regulatory agencies has been a retarding influence on economic expansion. In some cases two or more government agencies must be consulted before action can be taken. In some cases it takes years to get a decision that is needed to expand and create new jobs.

Almost every program of the government in the economic and business field could, with profit, be periodically reviewed in the light of current circumstances and future trend. It is almost axiomatic with us that an operation that has not been reviewed for 10 or 15 years usually needs a thorough new look; times will have changed, and there is a limit to the improvement that can be economically effected by considering small elements of the operation separately.

Another matter that may deserve some attention is the contribution of governmental regulatory activity to the rising tide of paperwork and recordkeeping. While much has undoubtedly been done to ease the burden of reports and questionnaires, it seems that when new legislation is being considered, the Congress might well require from the responsible committee a review of the probable increment to the Nation's recordkeeping. Reviewing the past 30 or 40 years, we need mention only the Social Security Act, Income Tax Withholding, the Selective Service Act, the Wages and Hours Act, the Labor Relations Act, the Pension and Welfare Funds Disclosure Act, and the recent Medicare legislative activities as examples of substantial increases in paperwork incidental to the basic purposes of the legislation. While many things have been done by people working cooperatively to simplify the recordkeeping processes in many of these areas, it is probable that more could be done, perhaps by reframing in some cases the basic concepts involved.

STATEMENT

Prepared for the Commission
by the
National Association of Manufacturers
New York, New York

Statement by the National Association of Manufacturers

The Impact of Technological Change Upon Our Economy and Society

Part 1. Some Observations on Automation and Employment

Basically, let it first be said that we fail to find hard evidence of drastic acceleration in the rate of technological change.

True, there have been startling developments in particular industries, but if automation were proceeding at anything like the rapid rates which have been claimed, the results ought to show up in the form of either a rapid increase in net unemployment or a rapid rise in the rate of productivity growth, or both. But neither of these consequences is to be observed, at least in the last decade or so in which the most dramatic strides in automation are alleged to have occurred.

A further weakness in the thesis which links alleged rapid increases in productivity to accelerating automation stems from the assumption that automation, or more generally the substitution of capital for labor, is the only factor causing productivity increases. This, too, is an erroneous notion. Of course, productivity may increase because of technological advances. But productivity may also increase because of improved management techniques in administration and plant operation; it may increase because workers are better educated, or healthier, or more mobile.

Clearly, investment in human capital, in education and training, has had and will continue to have a substantial effect on our productivity movements. More aggressive salesmanship in home and foreign markets may increase sales, raise the rate of capacity utilization, and to that extent increase the output per worker from given facilities. Productivity, in other words, is to an important degree a function of the salability of the output.

Like all processes of change, technology undoubtedly results in short-run frictions in the economic system. These frictions contain both a challenge and a danger. The challenge is to distribute both the short-run adjustment costs and the long-run benefits arising from technological change in such a way that the process itself is not slowed down. The danger is that the short-run adjustment process will give rise to widespread acceptance of the concept that technology, of itself, creates long-term unemployment.

The key to the problem lies in the relationship between growth and productivity. Each is a spur to the other. When an economy, an industry, or a company is growing rapidly, technological changes can be introduced more readily than in a situation involving little or no growth; economies of large-scale production are made possible; and if growth is more rapid than the accompanying productivity increases, no unemployment need result. At the same time, the cost reductions resulting from technological change and other sources of productivity increase permit a lowering of prices of the affected products relative to all other prices. This, in turn, encourages increased demand for these products, the exact impact depending on how responsive that demand is to changes in price.

This point that under conditions of rapid growth, productivity increases do not lead to continuing unemployment can be demonstrated in many ways. Internationally, the countries of Western Europe which experienced relatively high rates of productivity increase during the 1950's, at the same time reduced their unemployment rates. This indicates that their economies grew rapidly enough to absorb workers displaced by machinery and new entrants into the labor force, as well as some of those unemployed at the beginning of the 1950's. In contrast, the United States, United Kingdom, and Canada, with slower rates of productivity increase during this period, experienced increases in their unemployment rates (see table 1).

Looking at the industrial picture in the United States a similar picture emerges but it cannot be depicted with the same type of data. From a conceptual standpoint, there is no way to analyze unemployment on an industry basis. Therefore, our national industrial comparison must be made between productivity change and employment. Studies of long-run factors in

TABLE 1. UNEMPLOYMENT TRENDS COMPARED WITH RATES OF PRODUCTIVITY CHANGE IN SELECTED INDUSTRIAL COUNTRIES

Country	*Percent rate of productivity change* [1]		*Percent unemployed*		
			1951	*1962*	*Trend*
West Germany	4%	above average	9.0	0.7	Down
Italy	4		8.8	3.0	"
France	4		([2])	([2])	"
Netherlands	3	average	2.3	0.8	"
Belgium	3		9.8	4.0	"
Norway	3		1.1	1.4	Up
United States	2	below average	3.3	5.6	"
Canada	2		2.4	5.9	"
United Kingdom	2		1.3	2.1	"

[1] Average annual rates of growth in "real" GNP per employed person 1950-60.

[2] Not available in terms of an official unemployment rate. However, the index of nonagricultural employment rose during this period while the number of unemployed persons declined.

Source: National Industrial Conference Board; United Nations.

TABLE 2. RELATIONSHIP BETWEEN PRODUCTIVITY CHANGE AND EMPLOYMENT CHANGE IN 33 AMERICAN INDUSTRIES 1899–1953

Industry	*Productivity increase*	*Employment increase*
Oil and gas production	+	+
Paper	+	+
Printing, publishing	+	+
Chemicals	+	+
Petroleum and coal products	+	+
Rubber products	+	+
Stone, clay, and glass	+	+
Primary metals manufacturing	+	+
Fabricated metals	+	+
Electric machinery	+	+
Transportation equipment	+	+
Miscellaneous manufacturing	+	+
Telephone	+	+
Electric utilities	+	+
Natural gas	+	—
Metal mining	+	—
Nonmetal mining	+	—
Tobacco manufacturing	+	—
Textiles	+	—
Railroads	+	—
Local transit	+	—
Residual transport	+	—
Telegraph	+	—
Manufactured gas	+	—
Food manufacturing	—	+
Beverage manufacturing	—	+
Apparel	—	+
Furniture'	—	+
Nonelectric machinery	—	+
Anthracite coal mining	—	—
Bituminous coal mining	—	—
Lumber products	—	—
Leather products	—	—

+ Indicates a percent increase greater than that for the private domestic economy as a whole.

— Indicates a percent increase smaller than that for the private domestic economy as a whole.

Source: Kendrick, John W., *Productivity Trends in the United States*, pp. 212-213.

the economy indicate that in industries with productivity increases more rapid than those experienced by the economy as a whole, employment has grown faster than the overall industry rate more often than it has grown at below average rates (table 2). Similarly, the overall performance of the American economy between mid-1964 and mid-1965 provides a short-run illustration of what can be achieved through growth. With "real" GNP increasing at an annual rate above 4 percent, the economy was able to absorb an increase in the labor force of more than 2 million persons, and at the same time register a decline in unemployment.

Since World War II, companies in practically all industries have been automating their production lines and processes as rapidly as possible. A survey by *Automation* magazine showed that $10 billion would be spent in 1965 to automate industry, with $6.5 billion going for equipment and $3.5 billion for controls. This emphasis on automation springs from companies' desire to reduce their production costs as much as they can, improve their production, and increase their output. The Machinery and Allied Products Institute has stated that the progressive reduction of equipment prices relative to labor costs has increased the amount of equipment per worker over 175 percent of the level 40 years ago.

But to put this situation in perspective it is important to consider the cost of automating. Yale Brozen of the University of Chicago, who speaks with considerable authority in this field, points out:

> To automate as completely as possible with present technology, only one major segment of the American economy, manufacturing, would require an expenditure of $2½ trillion (this comes to $12,000 per man, woman, and child, and the total stock of inanimate goods in the United States has been estimated to be worth only one-sixth more, $3 trillion).
>
> Even to modernize manufacturing to the levels of the new plants built in the 1950's would require over $500 billion, since total spending on new plants and equipment in manufacturing amounts to about $15 billion per year. American manufacturing could not be modernized even to the technology of the level of the 1950's for over 30 years, and this is under the extreme assumption that all the expenditure is used for modernization and none for expansion. With the current division of capital outlays between modernization and expansion, modernization to the level of new plants of the variety built in the 1950's would require about 50 years.
>
> To automate completely the manufacturing industry with no increase in total output would require two centuries at current rates of modernization. If we expand output at the rate necessary to keep up with population growth, however, present rates of capital formation will never result in complete automation of manufacturing unless the cost of automation is reduced to less than one-sixth of its present expense. This is unlikely to occur within the foreseeable future.

Basically, the potentials of technological change for increasing the standards of living in the United States can best be realized by the adoption of policies designed to foster maximum sustainable economic growth. It is through this route that jobs can be created in an economically constructive sense.

There are a great many forces and factors bearing upon employment and unemployment. The net ultimate outcome for the near term or long term is not yet clearly predictable. At the present time, there are skills which are in short supply and at the same moment there is increasing need for new skills that seem almost unavailable. Gradually we note there are other skills that seem less and less needed.

Until recently, trends in employment and unemployment seemed to favor the skilled as against the unskilled, nonproduction workers as against production workers, and white-collar people against blue-collar people. It is widely assumed that these trends reflected fundamental changes in the character of demand for labor and that they could be expected to continue indefinitely.

However, developments during the business expansion which began in 1961, and especially during the past 2 years, have called this assumption into question. Actually, employment of unskilled laborers and semi-skilled operators has been increasing faster since 1963 than total employment. The proportion of nonproduction workers in the manufacturing laborforce which had been rising steadily in the postwar period until 1960, has fallen slightly since that date. The unemployment rate among blue-collar workers is below its level in the prosperous year 1957, whereas the rate for white-collar people is slightly higher than in that year.

It is too early to say that the facts just mentioned indicate a fundamental reversal of previous tendencies. But they do suggest that fears of the effects of automation on relatively unskilled blue-collar production workers have been greatly exaggerated. Apparently, when the economy is prosperous and growing, employment opportunities keep pace with the job needs of the less trained and less skilled segment of the population. There is no sign that technology is rapidly leading us to a situation in which a large residue of untrained and untrainable people will be left with no place in the productive process.

The man who is adaptable, trainable, and not emotionally imprisoned by his past working or living environment will readily find and hold his place.

Finding the best solution for the short-run frictions which may accompany the process of change will help to preclude more drastic remedies which might endanger future productivity increases. Minimum wage laws, job maintenance, or job creation through artificial means, such as featherbedding or elimination of overtime by the imposition of stringent penalties, would merely result in a slowing down of economic progress.

Resort to shorter hours of work as a means of spreading employment opportunities, since it would undoubtedly be accompanied by pressure for maintenance of take-home pay, would not accomplish its objective. Instead it would product an inflationary potential. While Americans traditionally have chosen to take part of the fruits of productivity increase in the form of shorter hours, this should be a gradual process geared to the rate of productivity increase, not a sudden change adopted to solve a short-run problem.

Many companies are going to extraordinary lengths to make it possible for employees to switch from work at outmoded, older jobs to work on new products in new facilities. Sometimes this is done by locating new plants near those the company is closing and by extensive training and retraining programs to enable employees to shift easily to new products and more highly skilled jobs.

Some specific comments by significant companies regarding the outlook, as they see it, are set forth as part 2.

Part 2. Some Company Estimates of the Impact of Technological Change on Employee Patterns in Next 5 to 10 Years

An Integrated Producer of Forest Products

> Our job skill levels range from unskilled labor to many highly specialized technical positions. In looking at our anticipated employment patterns for the next 5 to 10 years we foresee no technological unemployment that cannot be absorbed by normal attrition. In the next 5 years we expect an increase in overall employment slightly in excess of 10 percent. Within that increase we do expect a somewhat higher level of manual skill requirements, and a commensurate increase in the number of clerical and administrative positions.
>
> Our 10-year forecast indicates a decreased requirement for personnel with limited educational background. We plan to maintain our basic educational requirement of a high school minimum.
>
> In general, we anticipate manufacturing employment to remain constant for the foreseeable future. It is expected that expanded production capacity would offset any reductions in total employment due to automation. We feel that opportunities with this industry, as opposed to elsewhere, will enable us to develop an outside hiring program with increased emphasis on getting better qualified applicants in terms of available skills and the will to work. With a few local exceptions we believe we will meet these needs from the labor force available in our plant communities.

In commenting on our attitude toward training opportunities, we strongly suggest some emphasis on improved local training capabilities to meet the job requirements within a geographic area. It seems desirable that some type of concentrated effort be directed toward the vocational training portions of our public school systems.

An Oil Company

The company foresees no acute problems in personnel reduction which can be attributed to technological or economic change. Automation is inevitable and is viewed as an essential ingredient of the petroleum industry's growth. Technological change in the industry is evolutionary. It has not been unduly rapid so as to be of disruptive nature, and it is anticipated that the company's employment patterns for the future will not involve major worker displacement. Technological change in the industry will continue at a moderate pace which will enable the company to reduce personnel through attrition primarily.

There is and will continue to be greater emphasis on skills and education to keep pace with the requirements of technological change. We have less and less need for unskilled workers. The petroleum industry seeks trainable people in whom skills can be developed to handle new processes. In this regard, the company is able to provide for the training of its employees. In most instances training has enabled our skilled and experienced employees to attain competence with new equipment.

The employment of professional employees will continue at a substantial level, and small numbers of wage personnel will continue to be hired at several plant locations.

We do not foresee any great external (energy sources outside the petroleum industry) technological developments in the next 10 years that will affect the industry.

A Flour Mill

The impact of automation and other technological changes is obviously going to be much greater in some industries than in others in terms of production and employment. In spite of considerable effort in the area of research and product development, the food industry is less technically oriented than is the average U.S. industry, and therefore the effect of technological change will be somewhat less.

In considering our company specifically, the value added by manufacture in flour milling is considerably less dependent on the efforts of manual labor than on mechanization. Relatively few developments have taken place in flour milling since the time when many of our mills were constructed around 1900. The labor input of our newest mills is little different from that of our oldest. In other words, flour milling has always been a largely automated process.

In considering the manufacture of other food products, we find the same general characteristic prevails, but to a lesser degree. Within the last 10 years bulk handling of ingredients and flour products has been largely effected. We see little further change in the next 10 years. One significant development also accomplished in the last 10 years has been the development of automatic palletizers. These are now capable of taking cases of products from the production stream and assembling pallets automatically. One change which may be possible in the coming 10 years will be that of converting customers to the ordering of complete pallets of a given product so that the pallet may be mechanically loaded onto rail cars without the present man hand-pulling of cases prior to shipment. The effect on employment would be minor, but increased volume could be handled with the present complement of personnel.

As new plants are developed, increasing levels of automation will be employed which will require some upgrading in employment standards. Present requirements based on validated testing measure primarily mechanical comprehension and adaptability. In the future the minimum qualifications will have to be raised, but we see little employee displacement as volume increases will require additional people.

One area where technological change has definitely affected employment is in the displacement of clerks and clerical supervisory personnel with the adaption of invoicing and other clerical tasks to the computer. The net result in our company has been a reduction of 350 field people from various parts of the country. This has been offset by the addition of some 150 people at other plant locations. The types of people now employed are chiefly in the computer programing and computer operation vocations. While hiring standards are somewhat higher, a major part of the training is done on the job. In the next 10 years, we see much less of this type of displacement since it has essentially been accomplished. The total might reach about 50 percent of the net change of the past 10 years. We also see some switching from middle management skills to computer technology.

While the effect upon employment will not be great, the major efficiency will be obtained in the material usage. For instance, in the past 4 years, while there was some reduction in employment there was a 40 percent increase in the number of items handled. This trend should continue to some extent.

A Ball Bearing Manufacturer

Our views can best be summarized briefly as follows:

1. We endorse and support the conclusions about the effects of and solutions to the problems of "automation" presented in the Machinery and Allied Products Institute book, *The Automation Hysteria*, prepared by George Terborgh. Both history and logic indicate technology does not result in a loss of jobs in the total economy. Economic growth and increased welfare accompany automation and technological change. The problems created by these developments should be solved by steps to make the labor force more flexible, mobile, and adaptable.

2. Our own experience has been that employment has increased along with the greater use of computers and the introduction of new technology and automation. Total volume has risen and the distribution of employment among the various types of

jobs has changed. We are in a better competitive position particularly vis a vis foreign producers. We have no way of disentangling the various forces at work and determining just how many additional jobs were created by increased automation and technological change but there has been an increase.

3. Looking ahead 5 or 10 years we anticipate a decline in our need for routine hand clerical, inspection, and material handling workers. We expect increases in the number of business machine operators, engineering technicians, electronics technicians, and machine tool builders. These are in addition to the changes resulting from normal growth.

4. Because of the diversity of problems and because of their difficulty and the resultant need for variety and experimentation in finding solutions, we suggest Government encourage private activity to facilitate occupational adjustment and geographical mobility.

An Electric Utility Company

Like many other companies in the business of supplying electric energy, we have had experience with "automation". It does present problems, but its effect on employment has been greatly overrated. In our own experience, the change is gradual and the work force has been adjusted without layoffs, through retraining and attrition. Here are two examples:

. . . In changing over to electronic data-processing equipment, the shift stretched over about 10 years from inception to completion. No layoffs were made, but there was some reduction in force through attrition. Production increased, with a consequent lowering of the costs involved in customer billing and allied transactions.

. . . Another change contrasts one of our older steam generating plants and one of the newest. The new plant was manned largely by employees from the older plants, so the problem of dislocating employees by change did not occur. However, there was an impact on the older plants, since they were not operating when the system load was light. In one sense, many of the employees in the old plants were surplus, but it was not economically feasible to abandon the plants. Even if on "standby", about the same number of employees were required. There were no layoffs.

Our substations have been gradually made "automatic" over the years. The operators are assigned to a group of stations, which they visit periodically or on signal. The total number has been reduced from that required when an operator was in attendance at the larger stations 24 hours a day, 7 days a week. However, there were no layoffs. Attrition reduced the force, and conversion was made at a rate which did not make employees "excess" except for a temporary period. The present force is more highly skilled and higher-paid than the former attending operators.

A computer has been adopted for the work of system supervision or load dispatching. As nearly as we can determine, this will not cause any reduction in the number of men required. Its effect has been to absorb some of the more routine work, and improve the speed and quality of control.

A study has been under way, estimated to take 2 years, of EDP equipment applications to paperwork throughout the company. Assuming that it is recommended, we look for about the same sort of problem that was experienced in the changeover from mechanical to electronic equipment in customer accounting.

The foregoing "automation" changes have caused problems. However, the problem of displaced employees is just as severe from causes that have nothing to do with automation. Development and installation of conveyors to handle coal has dislocated some employees. Others have been displaced by the substitution of Euclid earth-moving equipment for locomotives and locomotive cranes.

A change in the organization of our maintenance work in 1953 caused personnel problems similar to those usually associated with automation. In early 1953, each of our major power plants had a force of skilled tradesmen large enough to handle the average workload. They were in trades such as electricians, pipefitters, stoker repairmen, pipecoverers, and painters. We also had a centralized construction department which supplemented the local plant force for major projects. Late in the year we established a skeleton force of general mechanics—combination electrical and mechanical repairmen—at each of the plants. The remaining tradesmen—some 250—were transferred to the centralized construction and maintenance department, remaining in their trade. This disrupted previous reporting points, supervision, working hours and conditions. There were a few layoffs in 1958–1960, due to a lessening of new construction work. A relatively smaller work force today is handling a larger volume of maintenance work. The reduced number is due to reorganization of the work, not "automation". The skill levels and pay rates have increased materially.

In our construction activities, mechanical equipment has taken the drudgery out of much manual labor, such as digging trenches and climbing poles. This is equipment such as bucket trucks, backholes, sod cutters, and tampers. It reduces manpower otherwise required, but is not "automation."

In brief, we believe that changes in organization, in methods of doing work, in materials, and in use of power equipment have more effect on manpower requirements than "automation." In either case, the impact on employees can be lessened by planning the moves to coincide with attrition, by retraining, by layoff allowances if there is no alternative. Right now, in our area, there is a shortage of skilled tradesmen and qualified learners.

An Airframe Company

Changes in the composition of the work force in our company over the past 10 years reflect a shifting of employment from blue-collar workers to white-collar workers. Also, as generally expected, there is a sharp decline in the unskilled worker category and a lesser decline of the semiskilled worker. It is significant to note, however, that the rate of decline in blue-collar employment is slowing down.

The changes in our work force over the past 10 years are due almost entirely to our changing products, which result from technological advances. The product shift from airplanes to missiles to space vehicles has created the need for many more managers, engineers, and technicians, while decreasing the requirement for production workers. Automation, although an important expression of technological change, has so far had little direct effect on the changing skill mix in our industry. However, as we continue seeking cost-cutting methods and techniques, we expect automation to increase as a specific factor in changing our occupational categories over the next 10 years.

During the next 10 years we believe that the trend of increasing white-collar employment in our industry will continue, but at a slower rate than during the past several years. We also believe that the education and skill levels required will continue to go higher, causing even greater problems for the uneducated and inexperienced person.

A Chemical Company

It is an almost impossible thing to predict where technological change is going to be most conspicuous over the next 10 years. It has been occurring in practically all lines of activity and we have to assume that it will continue to do so, but where the greatest impact will occur in terms of industries, jobs, and geographic areas is an exercise in futility.

Technological impacts appeared first in the productive processes, both farm and industrial. They have now spread to practically all lines of activity, including the white-collar jobs and the service industries. The impact on employment has been most conspicuous among factory workers. The effect has been no smaller in the white-collar areas, but because more displaced persons in this group have been able to find other jobs, there has not been so much clamor regarding the unfavorable impact on workers. Perhaps this is because with somewhat higher average education and with the kind of skills that can be adapted to a variety of jobs, these people have greater job flexibility. In addition, the growth of the white-collar and service industry jobs has minimized the problem.

One key point is that the rising cost of labor, particularly unskilled labor, is the basic justification for capital installations which eliminate jobs. At the present time average labor rate often is $3 per hour plus about $1 in fringe benefits. Four dollars per hour times 2,000 hours per year creates a cost of $8,000 per individual. If the job is a 3-shift, 7-day per week activity, the labor cost is $33,600 per year. A capital installation of $150,000 which eliminates a job completely will therefore make a return of about 6 to 10 percent net after taxes on investment. This is exactly what has been going on in the chemical industry and is accelerated every time labor rates are raised.

The simpler jobs, such as packaging and loading of trucks and railroad cars, are among the most obvious points of attack, since most chemicals and plastics can be handled automatically. The same point applies to maintenance, however, since more expensive and more reliable equipment and greater instrumentation can be justified as a means of avoiding maintenance work.

Obviously, the type of worker most readily affected is the nonskilled worker, since the only jobs left are the ones requiring a high degree of training and a high degree of individual responsibility. Geographically the greatest impact is likely to be felt where there is the greatest concentration of unskilled labor.

Unquestionably, as the insatiable demands of unions are thrust upon industry, greater efforts will be made to streamline and automate those tasks which normally and historically require the application of muscle and the human nervous system. Such being the case, there of course will be resultant problems for the Nation on the economy as a whole, particularly with regard to retraining and upgrading the skills of our people.

There is likely to be a continuing gap between the demand of industry and the location and capability of talent at any one point and time. Thus, in thinking in terms of the geographical areas which are most likely to be in continued difficulty, one might well identify portions of Appalachia as well as particular concentrations of skilled and untrained labor in the South. We will continue to see a shift from rural to urban areas with all the resultant problems that may possibly occur with this kind of migration.

Part 3. Channeling New Technologies into Broader Areas

As pointed out in part 1, the economy's rate of growth and the levels of unemployment do not indicate that we have been experiencing an acceleration of technological advancement nor can we predict that such a period will occur in the future. Further, new patent applications confirm that view.

The NAM has pointed out in its statement with respect to the State Technical Services Act of 1965 that the U.S. Department of Commerce has established recently a Clearinghouse for Federal Scientific and Technical Information. The purpose of this monthly publication is to disseminate to scientists, engineers, librarians, and management new-classified Government technical information. This is such a recent development that it is impossible to assess its effect in more effectively channeling new technologies throughout industry for more widespread adoption. However, we do believe that it is a constructive step by Government in the right direction.

In the private field, it was also noted in our statement that there are more than 2,600 business and professional publications issued regularly. They cover every conceivable occupation and their major purpose is to make known to those interested in the field the latest technological developments through articles and advertisements. That these publications prosper and their number continues to grow is an indication that, to some degree, they fulfill their purpose.

Therefore, it appears to us that efforts on the part of both Government and private industry are being applied constructively to the problem of channeling new technologies over broader areas.

A further constructive step, recently inaugurated in the U.S. Senate, was the hearings on Government policies with respect to patents. Testimony overwhelmingly supported the proposition that a change in policy would promote the use of new technologies discovered through Government contracts into civilian industries.

Present policy under Government research and development contracts, in many cases, vests the rights to new inventions in the Government.

According to testimony, many companies which have done considerable research in a particular area and which would hold basic background patents refrain from bidding on Government research and development contracts for fear of losing their background rights. This deprives the Government from obtaining the services of the company which may be the most knowledgeable in the field and results in duplication of effort and waste of money and scientific manpower.

Further, it is a rare occurrence that an invention made under Government research and development contracts can be adapted to civilian or commercial use without the expenditure of considerably more time and money for further development. However, if the Government holds the patent rights, there is little incentive for private enterprise to make these expenditures if it does not have the patent right to exclude others from using the inventions. The Government does not have the right to exclude others, nor should it, but since Government-owned patent rights are available to all, the incentive to risk funds to develop and market such an invention is lacking.

A change in Government patent policy to vest the right to new inventions under Government research and development contracts (except in unusual cases) in the hands of the inventor would enhance the prospects for greater industrial application of inventions discovered under Government contracts. Bills to accomplish this change in patent policy have been introduced in the Senate. Passage of such legislation would be an effective means for channeling new technologies into promising directions.

Part 4. Some Comments on the Overall Task of the Commission

With respect to the general approach of the Commission to its assignment, may we make four comments:

1. Extensive fact-gathering, research, and analysis is under way on this subject, but unless the business input is combined with that from universities, unions, and Government, it is unlikely that the intent of Public Law 88-444 can be realized. This fact would have special pertinence in decisions as to how public monies for research on these questions are to be allocated.

   Our thought on this is that coordinated solutions of real problems and the exploration of tomorrow's real opportunities will flow from constructive research by all interested bodies, rather than merely defending points of view or advancing the self-interest of constituents.
2. The business community has amply demonstrated that it can and will train people to do the jobs which need to be done. It is spending billions of dollars annually to this end.

   If State and local governments can be encouraged to continuously improve and broaden our educational system by graduating young men and women who are well versed in English, mathematics, science, history, and the arts, this would be a great spur to economic growth. We can train people if the schools will educate them.
3. If we are to provide opportunities for an expanding population and provide job opportunities for those whose skills are made obsolete by technological change and automation, a primary area of such job opportunities must be in the service-oriented businesses. We suggest that the key to at least the economic aspects of our minority group problems lies in the growth of service-oriented businesses because job opportunities are most readily available in the fastest growing segments of the economy.
4. Opportunity for profit is essential to opportunity for employment, for the former creates the latter.

   The general profitmaking atmosphere, therefore, becomes a prime consideration to anyone planning to start or expand a business.

   If the Commisison's final report reflects the position that the role of Government is to create the economic climate which will lead to increased consumption and investment and therefore, more employment, it will do the Nation a genuine service.

   An important part of the prescription for higher employment is a revision of the tax structure so that industry is encouraged to modernize its plants and equipment and realistic depreciation guidelines are laid down. A reduction of the Government's drain on savings would better serve the country as investments in growth than in taxes to cover, among other things, welfare programs made necessary by the lack of growth.

APPENDIX

NAM Policy Position
on
FACILITATING ADJUSTMENT TO CHANGE
Approved by NAM Board of Directors
December 1964

The increasing velocity of progress requires a sharpening of the traditional efforts by private institutions to aid people in meeting their individual responsibility of adjusting to change and participating in its benefits.

Industry believes that it should encourage voluntary study and action to meet local needs for the adjustment of individuals to change. Such study should include ways to ease employee shifts to new occupations and methods of equipping individuals to relate their capabilities to changing job content.

STATEMENT

Prepared for the Commission
by the
National Farmers Union
Washington, D.C.

Statement by the National Farmers Union

The following are viewed as unmet community and human needs:

> *Community:* zoning, educational facilities of all kinds, development planning, land use for other than agriculture, water facilities and flood control, medical and hospital services, balanced and stabilized economy, senior citizen housing, recreation facilities for all ages, police and fire protection, all-weather sundary road system.
>
> *Human:* adequate disposable income, full and equal educational opportunity, health and medical services, decent housing, counseling and occupational guidance, retraining and manpower development.

New technologies may best be applied to the rural sector by means of national policies directed toward solution of the most pressing needs—income, employment, opportunities for higher education, and health and welfare facilities. Short of national policies with interregional application, States are limited in what they can do.

As regards financing, the terrific capital draining out of rural America needs to be reversed by means of national-State programs which revitalize rural economies.

Producers of raw material have always been disadvantaged in the marketplace. This economic disadvantage of paying at administered price levels and selling in buyers' market can be remedied only by means of broad national policies.

The development of a mixed and stable rural economy will initially be stimulated by means of encouragement of agriculturally related industries. Agriculture is a rapidly enlarging industry, even though the means of agriculture are in transitional stages—larger farms and greater capital requirements.

In spite of the radical changes being experienced in agriculture resulting in greatly increased per man-hour productivity for the foreseeable future, the geographic distribution of agriculture will remain stable. The surplus of manpower will continue to flow out of agriculture even under the best of circumstances.

A hard look needs to be taken at (1) providing for the continuation of a private enterprise system and policy in agriculture, (2) ways and means of recapitalizing rural America and making the transfer of equity capital a workable process, (3) long-range development programs to rehabilitate the towns and cities and their peripheral service areas, and (4) articulating the Nation's responsibility for the adjustments rural people have to make wherever migration or change of occupation takes place.

Unfortunately, neither local nor State governments can generate the type of regional planning which is needed. Interstate compacts attempt this, particularly in water use and power arrangements. However, the broad regional development of a Missouri Valley Basin involving multipurpose development is as necessary as Federal initiative in an Applachia program.

STATEMENT

Prepared for the Commission
by the
National Marine Engineers' Beneficial Association
New York, New York

Statement by the National Marine Engineers' Beneficial Association

In reply to the Commission's request for pertinent data on various phases of technological, automation, and economic progress and its effect on productivity and employment with this industry, it embarrasses us to answer that we do not know, and therefore hesitate to answer the five questions you have posed to us.

The main reason for our hesitancy is the attitude on behalf of the management and Government within the subsidized segment of the marine industry. Reference is pointedly made to the subsidized segment, since the majority of new ship construction is on their behalf. Perhaps we can aid you by referring to the technological and economic progress achieved by the nonsubsidized companies by examining the capital investments of these smaller companies.

In the past decade there have been many changes prior to the introduction of "automation" to our industry. Unfortunately even with all these changes our industry, once the largest in the world, is rapidly shrinking to one of the minor shipping nations. The most noteworthy advances have been made by the nonsubsidzed or independent operators. The mainstay of their fleet during the fifties was the 10,000-ton vessel with a crew of about 50 men. Today, plying in the same trade, they have faster vessels with an increased carrying capacity but with no increase in crews. As an example, a vessel in excess of 100,000 tons has a crew of 50 men. Therefore, today, one such vessel can effectively displace 10 vessels and crews of a decade ago. In this manner the independent operators have remained in operation without Government subsidy.

The independent segment of the industry must be commended on their forthright approach in their shipbuilding program. It was through an effort made on behalf of labor and management that the development of the larger competitive vessels was achieved. The independent companies have cooperated with the labor unions and conferred frequently to discuss the technological changes and their impact upon employment. It was through such meetings that mutual agreement was achieved with a minimum of labor-management conflict.

The subsidized segment of the industry is dependent upon the Federal Government for subsidies to construct and operate their vessels. The subsidies are basically used to maintain U.S. flag vessels competitive with foreign flag vessels on specified routings. The Federal Government as represented by the Federal Maritime Commission has considerable influence over the operation and construction of the subsidized company fleets.

At present, a majority of the vessels built under a construction subsidy contained within the Merchant Marine Act of 1936 are reaching the end of their economic lifetime and are due for replacement. In an effort to reduce the cost of the operating subsidy the Federal Maritime Commission has set forth automation programs for subsidized vessels now in operation and vessels soon to be constructed. The programs for subsidized vessels now in operation vessels to be reduced by the inclusion of "automation features."

The marine industry or the Federal Maritime Comission do not have facilities for developing and testing automation features required aboard new shipboard construction but depend upon vendor-developed equipment being placed into service with the hope that it will be functional.

The Federal Government is controlling the addition of automation features aboard subsidized vessels by edict, not through logical development. Currently, all new ships now require the inclusion of designated control elements and subsequent manning reduction prior to the company receiving approval for a construction subsidy. The labor unions whose members are displaced by the manning reductions have no information presented to them from either the company or the Government setting forth the features which outline the justification for manpower reductions. Furthermore, the act of putting a ceiling on manning without basing the reduction upon careful consideration and study or conferring with the affected unions has caused labor unrest in the maritime industry. Consider the problems caused by the Government edict placing a ceiling on manning. The companies are required to inform the unions that there are a limited number of jobs, and each union will have to take a reduction in jobs whether they are directly affected or not by the new features. The end result is disunity among the unions. Each labor group is forced to obtain the best manning agreement upon their own.

How effective is this method? The inept approach of the Federal Maritime Commission in presenting a specter of automation by edict in the marine industry has caused the state of present labor-management chaos. The Marine Engineers' Beneficial Association is now [July 1965] engaged in a major strike with most of the subsidized shipowners because of shipboard manning issues.

Automation and technological advancement can be brought to our industry, but not by edict as practiced by the Federal Maritime Commission or by burying one's head in the sand as practiced by the companies. We believe that secrecy should be eliminated and that the advances needed by the industry be brought out and discussed in a forthright fashion. Labor should participate actively in the application and development of technological advances and its effect on employment. It is only through mutual understanding and agreement between labor and management that the current problems created by the misapplication of technology can be rectified.

STATEMENT

Prepared for the Commission
by the
National Tool, Die, and Precision Machining Association
Washington, D.C.

Statement of the National Tool, Die, and Precision Machining Association

Introduction

The information contained in this report was obtained from questionnaires completed by 112 tool, die, and precision machining companies located in different geographical regions throughout the Nation. In 1964 the respondents employed 7,300 persons and reported total sales of $133 million. The range in number of employees was from less than 10 to more than 500; in annual sales, for less than $50,000 to more than $9 million. In all important respects, the respondents can be considered representative of the total industry.

Statement of Purpose

The purpose of the survey was to elicit information most accurately reflecting the influence of automation and new technology on all phases of the industry, both as that influence has already been felt and as it is expected to be felt. Information was obtained for the years 1956, 1964, and projected for 1968.

Definition of the Industry

The tool, die, and precision machining industry can best be understood by comprehending its essential bedrock role as a supplier industry.

The products of tool and die companies do not appear on superhighways, nor do they beautify homes or compile employee payrolls. But it would be impossible to produce automobiles, color telephones, office machines, or any mass-production product without tooling—and this comes from the tool, die, and precision machining industry.

Tooling represents a number of operations; the word is an umbrella that covers about a dozen meanings. Tooling can mean punches, dies, molds, jigs, or fixtures, all used singly or in combination in metal-cutting or metal-forming machine tools to produce consumer and industrial goods or their parts and components.

Tooling can also mean the special machines engineered and produced by tool and die companies to perform new, highly specialized production operations, or to improve upon former machines or methods.

Precision machining is a more recent aspect of the tool and die industry, stimulated to a great degree by the astonishing growth of the aerospace industry in the last decade. Tool and die companies have always performed what was regarded as precision machining, but the supercritical requirements of space vehicles demanded new and higher standards of the industry. Customer demands for longer-lasting, more reliable products have also led many consumer industries to impose stiffer quality standards on their tool and die company suppliers.

As an industry, precision machining is generally understood to mean the production of close-tolerance prototypes and piece parts. Tool and die companies also employ precision machining to make their more standard products—the punches, dies, and other items mentioned earlier.

Industry gets its tooling from two sources: from captive shops, operated by large manufacturers as a source of self-supply, and from contract shops. This survey is concerned only with contract shops, although some of the conclusions may be valid as well for the captive shops.

The tool, die, and precision machining industry encompasses an estimated 6,000 contract shops employing more than 125,000 persons—predominantly skilled toolmakers and diemakers, and skilled and semiskilled machinists. Employment in some single companies reaches several hundred, but is much more likely to fall between 10 and 50 persons. Total annual industry sales are curently estimated at about $2 billion, or about 6 times the 1939 figure. It is apparent from this figure that the industry is relatively small; but its customers include almost all the major U.S. corporations, and the tool and die companies must produce work acceptable to those companies. In many respects, then, automation and new technology have not only affected the industry directly but they have also exerted an indirect influence through their customers.

Selection of Major Impact Areas

The respondents were asked to evaluate several individual factors in five categories, choosing within each the factor that had most contributed to change within that company.

Factors cited most often were equipment replacement and machine obsolescence, which, if considered as related factors, drew 51 "most important" responses.

The other "most important" individual factors, by highest number of mentions, were skill requirements for production workers, specialization, quality control, diversification of customers, training programs, competition, and tighter tolerances.

By broad category, the most sharply felt changes had occurred in methods, men, machines, and markets. Materials, a fifth category, was considered far less important than any of the other four.

A Discussion of Major Impact Areas

1. *Machines.* As stated, equipment replacement and machine obsolescence, assuming a relationship between the two, dominate the individual factors of change in the character of the industry.

An examination of normal tolerance ranges, the percent of assets by products or services, and the percent of assets by customer or end use indicates the influence of automation and new technology in this area. The trend toward tighter tolerance requirements implies the need for new, automatic machine tools to remove or at least minimize the possibility of operator error.

The sharpest change in percent of assets by products or services has come in the precision machining area, where the tools of a decade or more ago are often technically unable to meet today's new, higher specifications. Thus, a total of 63 companies reported having assets in the precision machining field in 1964, an increase of 40 percent over 1956.

The figures for assets by customer or end use also point toward a greated employment of automated tools of one kind or another. The only significant increases by customer category were registered in the space, other military, and business machines and electronics fields—precisely in those areas where the single, most important manufacturing change has been a faster reaction time from design conception to production. It is these industries that have been the quickest to demand precision, short-run tooling and prototypes which are often produced most efficiently on electronically or otherwise automatically controlled machines.

The tool and die industry is also beginning to feel similar pressure from the automobile industry, which, to satisfy customer demands for more and more models and options, is moving toward automated production of its tooling. Since the automakers and their suppliers represent the number one market of the tool and die industry, it will have to react in kind to retain that market.

2. *Methods.* It can be stated almost without reservation that automation and new technology have been behind nearly every marked change in methodology in the tool and die industry, whether in the production or management area. To understand this, these changes must be regarded in the broadest possible sense: not simply as machines and processes, but rather as a psychological attitude of seeking always to do something better or faster.

Tool and die companies, sharing that attitude, have moved roughly with the rest of the metalworking industry both in adapting and reacting to automation and new technology. Some operations peculiar to tool and diemaking have not yet been—and possibly may never be—amenable to specific new production methods. But where methods have been evolved, the industry has shown no reluctance both to employ and benefit from new methods.

In the shop this has meant a clear trend toward the use of electrical discharge machines to produce stamping dies, plastic molds, forging dies, many aerospace parts, and other products. In the last year or two tool and die companies have begun to adopt numerical control, a machine method by which machine tools are operated by a numerical code, usually fed into machine control systems by punched paper tape. This method is most profitable for short runs and prototypes which traditionally have dominated the workloads of tool and die companies.

Whatever reluctance there may have been to employ numerically controlled tools has usually been traceable to one of two factors: 1. a legitimate desire to learn more about the technique before using it, and 2. the cost of the machines, which can run 2, 3, or 4 times as much as a similar machine without the control system.

Both of these factors are easing off in importance. Educational seminars, the business press, and other communication mediums have brought information about numerical control within the reach of most. And machine prices have been reduced, either absolutely or relatively.

Absolute reductions have occurred in the most generally used machine tool lines, which, as they became accepted, have been able to be produced in greater quantities with subsequent price cuts. More interestingly, users have begun to recognize that the greater costs of these tools are more than offset by increases in machine utilization and thus in productivity per man-hour.

In the management area, more and more attention has been demanded by production scheduling, cost accounting, estimating procedures, and other management functions. All are affected by, and in turn affect, changes taking place on the shop floor.

For example, not too long ago an extremely complicated and precise job would probably have been delivered in a correspondingly long time. But the trend today is toward more precision and shorter delivery times; therefore, the situation demands that some way be devised to do a better job faster.

Many responses are possible to that kind of challenge, with a specific piece of automated equipment only the most obvious. The fundamental factor as far as automation is concerned is not the purchase of a specific piece of equipment, but that the purchase will have been brought on by an "automation situation".

3. *Men.* The tool and die industry is heavily dependent on skilled labor—more so than the "normal" industrial hard goods manufacturer. The labor content of tool and die prices, as a consequence, is abnormally high, runing to about 70 percent.

Automation and new technology—again using the words in a very broad sense—have certainly not reduced the labor force in the tool and die industry. Total employees per company rose from an average of 45.9 in 1956 to an average of 68.9 in 1964, and the figure is expected to rise again, to 82.3, by 1968. Even while direct labor employees decreased as a percentage of the total work force, they rose in absolute terms over the same 1956 to 1964 period.

Much more significant is the number of direct labor hours worked, which rose from an average of 2,237 in 1956 to 2,269 in 1964. Assuming a normal work year contains 1,900 to 2,000 hours, overtime is obviously a definite characteristic of the industry. In other words, the requisite skills are in too short a supply to get the job done on time and to specifications without overtime employment. And this is occurring even while great technological strides permit more work to be done in less time. This must imply that whatever the productivity gains, the market has so far been more than able to consume those gains, keeping more people on the job and working longer hours.

For the tool and die industry, then, automation has in no way been an unemployment factor. Automation has presented a challenge in another way, however, and that is in skill requirements. While these requirements have always been high, they are certainly being further raised by the new machines, processes, and management techniques being absorbed so quickly in metalworking today.

As with all metalworking companies, tool and die firms prepare employees for new or modified job functions. The operator of an electrical discharge machine, for example, must be able to comprehend not only its mechanical elements, but he must also appreciate its electrical and metallurgical aspects. Numerically controlled tools have opened up an entirely new job function, parts programing. Various management methods, such as value analysis and the so-called Zero-Defects programs, have led to training persons specifically for these tasks. Mathematicians, almost nonexistent today as a recognized job classification in tool and die shops, are expected to be on the payroll of most major companies in the industry within the next few years.

The list is much longer, but the point is simple—with each new technological advance, persons must either be imported into the industry with the required knowledge, the current work force must learn it, or persons from the outside must be brought in and instructed in it. Even when the knowledge can be purchased on the outside, the tool and die company is obliged to see that knowledge is transmitted to other members of the production or management staffs. There is too much interdependence of functions to permit otherwise.

As a result, tool and die companies are already placing great emphasis on training programs, an emphasis that can be expected to increase. It may seem a simple matter, but the implications are profound. One relatively large-size company, for example, is already planning to increase its supervisory staff from 10 supervisors to 12, representing a 20 percent increase. This is projected not so much because the supervisory load has become greater, but because at any time two supervisors are expected to be engaged in learning or updating their knowledge of some production or management function.

Apprenticeship training, which has always been the base of the tool and die industry's training efforts, has, with Government assistance, begun to overcome the skill drain in the industry. But the skilled manpower shortage is still acute, and can be expected to remain so for many years to come.

4. *Markets.* Sales showed a decline in the predominance of tooling and a trend toward greater diversification when analyzed from the point of view of product or service characteristics.

Tooling, which amounted to 52.3 percent of sales of all companies in 1956, declined to 41.1 percent in 1964, and is expected to decline further to 36.3 percent by 1968.

Sharp increases in relative importance occurred in proprietary products, which grew from 9.8 percent in 1956 to 15.6 percent in 1964, and in contract production, which grew from 9.8 percent to 13.6 percent over the same period. In both cases, further increases in the share of total sales are expected by 1968.

Lesser increases were recorded in precision machining, while special machines and "other" barely maintained their share.

The trend toward diversification is especially pronounced among larger companies. By 1968, these companies anticipate that no one of five specified products or services will make up more than 28.3 percent or less than 13.2 percent of their total sales. Proprietary products will make up almost a quarter of total sales.

Smaller companies, on the other hand, will continue to rely predominantly on tooling, and to a lesser but still important extent, on precision machining. The two items are expected to comprise 79.2 percent of 1968 sales of medium-size companies, and 73.0 percent of total sales of small companies.

Proprietary products, while increasing in significance for larger companies, are of small and declining importance to the other companies.

Looking at sales from the point of view of customer or end use, the following major changes are apparent:

(a) Business machines and electronics doubled their share of total sales between 1956 and 1964, going from 12.5 to 22.3 percent. A small further increase, to 24.5 percent, is expected by 1968.

(b) The importance of sales to the military is slowly increasing. Within this category, however, the aircraft industry percentage of all sales dropped from 12.1 to 6.7 percent between 1956 and 1964, while the space industry share rose from 0.8 to 5.3 percent.

(c) Sales to the automotive industry declined from 1956 to 1964, although the auto industry was still the largest single customer. By 1968, it is anticipated that manufacturers in the business machines and electronics industries will be buying as much as the auto industry.

(d) Sales to the appliance industry are expected to recover slightly by 1968 from a sharp drop, from 16.6 to 9.7 percent, experienced from 1956 to 1964. The 1968 appliance industry percentage is projected at 10.1 percent.

(e) Companies of all size groups tend to follow the same trend for the period encompassed by the survey, 1956–68. The only striking difference is that the importance of automotive sales for small companies remains relatively stable compared to the percentage decline which either took place or is expected to take place among larger companies.

Export sales demonstrate a definite upswing in interest and activity. Only 13 of the 91 responding companies reported any exports in 1956, and none were above 10 percent of total sales. The number increased to 24 by 1964, and 3 indicated that foreign sales accounted for more than 10 percent of total sales. The trend is expected to continue, with 37 companies expecting to be doing some export business by 1968.

Larger companies are more deeply involved in exports than smaller ones, and their involvement is growing rapidly. Among larger companies, fewer than one out of three had export sales in 1956; by 1964, it was more than half; and by 1968, it is expected to be three-quarters.

Local sales figures reveal a decided shift away from dependence on local markets. In 1956, 31 percent of all companies were purely local; by 1964, the percentage was down to 15.7. At the same time, the degree of dependence on the local market was cut: In 1956, only 13 companies made less than half of their sales locally; by 1964 the number had almost doubled to 25.

Smaller companies, as might be expected, depend more heavily on the local market than larger companies. But even the smaller companies are reaching beyond their local markets: By 1964, 60 percent of all small companies had some sales beyond 100 miles of their locations.

Summary and Conclusions

Automation and other forms of technological progress have had a definite impact on the tool, die, and precision machining industry, and this impact will unquestionably increase over the next 5 to 10 years.

Some conclusions might include the following:

1. The industry is an essential supplier of tools, dies, and other products and services on which other industries depend and will continue to depend for their technological progress.

2. The demand for the industry's products and services is at a high point at the present time, a state which is certain to continue into the foreseeable future. The basis of this future market is automation and technological prog-

ress, which place an ever greater total workload on the tool and die industry.

3. Electrical discharge and numerically controlled machines are being introduced into the industry at an evolutionary pace. These machines and other forms of technological change have increased productivity and enabled the industry to perform production tasks not previously possible. However, mechanization will come relatively more slowly to this segment of the metalworking industry because of (a) the all-around machinist skills which will continue to be required, and (b) the high cost of mechanization to relatively small companies.

4. In spite of productivity increases, the industry is under heavy pressure to produce more. This demand for the industry's output is growing faster than output can be satisfied, continuing a critical shortage of skilled labor which can be relieved only by recruitment and training. In this industry mechanization is not the solution to the skilled manpower problem.

5. Replacement and purchase of new, additional equipment will become mandatory as the industry reacts both to the demands of suppliers and intraindustry competition.

6. Further diversification and specialization can be expected as the industry utilizes new machines and methods to perform the old jobs, and ventures into new fields opened up by these new machines and methods. The high prices of particular types of new equipment and the skills necessary to operate them will tend to reinforce both diversification and specialization. Competitive pressures are particularly active in these areas.

7. The tool and die industry will continue to grow in sales, investment, and labor force, both in terms of individual companies and as an industry entity. Annual per-company sales almost doubled between 1956 and 1964, and are expected to increase by half again between 1964 and 1968. The number of companies having annual sales of less than $250,000 will continue to decline, and those with annual sales of more than $1 million will continue to increase. Respondents may well have experienced growth rates faster than those for the industry as a whole; nevertheless, the growth pattern is apparent.

8. Automation and other forms of technological progress have not only not harmed the industry in any discernible way, but they have strengthened it. They have required that the industry become more efficient, better managed, and more flexible, both literally and psychologically. The same pressures have always existed in the tool and die industry as they have in all industries; automation and technological advances have simply made the achievement of normal business aims more urgent.

STATEMENT

Prepared for the Commission
by
North American Aviation, Inc.
Los Angeles, California

Statement by North American Aviation, Inc.

(a) *Identify and assess the past effects and the current and prospective role and pace of technological change.*

Technological change has affected North American Aviation in almost every area—products, employee skills, equipment and facilities, and organization and management practices.

Our business is new knowledge and its reduction to profitable application, with research and development work providing about two-thirds of our dollar volume of sales. Advances in technology have opened up entirely new areas in electronics, missilry, astronautics, aeronautics, and atomics. Many of our products could not be built with the manufacturing techniques of only 10 years ago—indeed, some could not with the techniques available at the very time that the product was designed.

This opening of new areas has enabled our employment to exceed the peaks reached during World War II, when the company was one of the major suppliers of military aircraft. Were our products still limited to aircraft, employment in the company would be substantially below the current level, since aircraft products and services are now approximately 20 percent of our sales.

Due to the greater complexity and higher technical content of current products, the company encourages and financially supports employees in their efforts to further their own education and skills. Last year North American employees took over 13,750 courses leading to bachelors', masters', and doctors' degrees. During World War II our technical people generally specialized in mechanical engineering, although some were electrical or aeronautical engineers. Today some 175 different specialties are represented by North American employees holding 24,200 degrees.

During World War II about 80 percent of our employees were so-called blue-collar personnel; today, about 36 percent are. In absolute numbers the blue-collar classification has remained about level since 1955, while our total employment increased by more than 50 percent between 1955 and 1965. The company conducts training programs aimed at helping these people to qualify for higher positions; a special study made in 1961 disclosed that, partly as a result of these programs, over 2,400 blue-collar workers in our divisions in the Los Angeles area alone transferred to white-collar jobs in the 1960-61 period. Last year some 35,000 hourly employees completed company courses designed to upgrade their skills and to keep them contempory with today's needs. We have also had to go outside the company and provide a number of our suppliers with training courses to enable them to meet the higher skill requirements of current products.

As further evidence of the significant impact of technology on the personnel of the company, about 18 percent of our employees are engineers or scientists in the aerospace disciplines, compared with 8 percent in 1955 and 6 percent in 1950. Moreover, this increase is not in quantity alone. It is matched by an improvement in the education of our technical people; viz., the increase in technical people with advanced degrees has been faster than that of technical people holding only bachelor's degrees.

Technological progress is also one of the factors causing North American to institute a Manager Development Program. The need to find good managers from among professional personnel who can direct technical activities has compelled the company to broaden its search for such capabilities. A system has been established for identifying particular skills and experience throughout the company so that a larger choice of candidates may be provided for new openings at the managerial level. In short, this program attempts to systematize the development of managerial talent to make more certain that the most qualified and deserving are placed in positions of responsibility.

Serving as a tool for this and other programs is the Qualification Inventory, which provides a ready reference of the various talents and experience available in all fields throughout the company. Through this technique, a Skills and Capabilities Summary is maintained on all salaried personnel. When there is a need, even on a temporary basis, for someone of specialized abilities and/or training, the criteria are programed into a computer which, in turn, provides the names of one or more employees answering these requirements. More detailed profiles of these particular employees are then consulted to help determine the choice in filling the opening. By such means as this, we are able to satisfy critical requirements for highly specialized personnel.

The company spent over $230 million in the last 6 years for new facilities. A large portion of these capital expenditures has been for research equipment and other highly specialized facilities needed to meet the demands of advanced technology programs. Laboratory floor space increased from 82,000 sq. ft. in 1947 to more than 1.6 million sq. ft. in 1964. And the company's independent research and development expenditures (partially reimbursed by the Government) increased from $1.6 million in 1953 to $37 million in 1964.

Organization and management practices have also been affected. Technological advance has made possible the design, development, and production of systems and components with very high performance characteristics. These have required the coordinated efforts of talented people and complex equipment in many professional disciplines. The management of these simultaneous efforts and the integration of newly designed components and subsystems during the developmental phase have required extraordinary improvements in administration.

Our first major response was to organize divisions in 1955 that specialized in somewhat specified product areas. Next, within these divisions, we moved away from organization along functional lines toward program organization. Each major program has its own engineering, manufacturing, quality control, logistics, contract administration, and other departments—with certain portions of some functions remaining unchanged where we find centralization to be more efficient. These structures provide the needed flexibility in an industry and company in the forefront of technological advance.

The development of electronic data processing equipment and of management methods such as the Program Evaluation and Review Technique (PERT), PERT/COST, have provided effective tools to upgrade the information on which management bases its decisions.

With regard to the prospective role and pace of technological change, we believe that this will be a paramount factor in the future of our company. North American is heavily oriented toward research, development, and production of products and systems of very high technical content. We believe that the demand for higher performance systems and equipment will continue in the foreseeable future, and we are prepared to continue meeting these challenges.

In broader perspective, the pace of technological change will be determined by the volume of effort applied by national private and public institutions. So far as private companies such as ours are concerned, this effort will, in turn, be determined by the prospective markets. With regard to North American's markets, we believe that the United States is committed to a continuing space exploration program, and that it will also require defense systems of very high performance in the years ahead. We will continue to respond to the Nation's needs in these fields. Moreover, the scientific and engineering progress made in these two fields over the past few years has made possible the conquest of some large-scale community and human needs, as outlined in our answer to number (c).

Therefore, to the extent that the United States continues or expands its commitment in these fields and incentives are maintained for private participation, technological change will proceed at least as fast as its present-day pace.

(b) *Identify and describe the impact of technological and economic change on production and employment, including new job requirements and the major types of worker displacement, which are likely to occur during the next 10 years; the specific industries, occupations, and geographic areas which are most likely to be involved; and the social and economic effects of these developments on the Nation's economy, manpower, communities, families, social structure, and human values.*

We expect the technological trends of the past 10 years to continue dominating the next 10 so far as the company's production and employment are concerned This means continued high technical content in our products, upgrading of personnel skills and education, and investment in still more advanced facilities.

Automation has not posed any significant personnel problems for the company because our trend has been toward custom manufacture of products with high technical content requiring individual and small-group talents. We expect our personnel will continue to develop the higher skills required.

A principal area of automation that will continue to grow is the use of data processing. Primarily this is a direct result of the enormous growth in the volume of data required in our work. Our use of computers and other data processing equipment has grown with this requirement, with very little displacement of existing personnel. Likewise, use of tape controls in machine tooling has not brought significant personnel changes. It has stimulated some of our people to take more training in mathematics and thus to achieve higher job classifications.

In connection with social and economic effects, it should be pointed out that aerospace companies such as North American have acquired over the past 10 years the ability to manage large system development programs of unprecedented scope and complexity. This ability can also be applied to large-scale projects for meeting community and human needs, some examples of which are discussed in number (c). In our belief, the fulfillment of such projects will not be limited by technical barriers. It will hinge largely on the degree to which the Nation as a whole becomes actively interested and engaged, and on the adequacy of financial arrangements between private industry and Government.

(c) *Define those areas of unmet community and human needs toward which application of new technologies might most effectively be directed, encompassing an examination of technological developments that have occurred in recent years, including those resulting from the Federal Government's research and development programs.*

Some 87 potential projects were recently listed in the recommendations of the President's Committee on the Economic Impact of Defense and Disarmament under the chairmanship of Gardner Ackley. The committee's excellent and comprehensive study covered 17 areas of need, including such areas as Panama Canal substitutes, Post Office automation, worldwide weather monitoring, antinoise programs, new cryogenic industries, and a dozen others. Some of the 87 proposed projects would encompass long-range programs of major scale, stretching over a decade or longer.

Rather than retrace ground already covered by that survey, we shall merely direct attention to just five urgent needs that might be met almost immediately by applying comparatively little-known but already-proven technologies.

In each situation, the need can best be met by timely development of a well-integrated system rather than by piecemeal additions of new hardware and/or new procedures. The same special management techniques that have produced major space systems and weapon systems of great reliability offer the best hope of efficiently meeting these needs. As you know, organizations skilled in systems management are experienced in working under Government contract toward definite objectives of great technical complexity, to be accomplished within specified limitations of time and resources. Such organizations have learned how to integrate hundreds of technical and nontechnical activities in creating a single advanced system; how to plan concurrent work on problems that conventionally would be dealt with in succession; how to maintain flexibility in adjusting to changes in requirements arising continually as a program evolves.

Here are some of the needs toward which today's technology and skill in systems management might well be directed.

Health. It has been estimated that up to 400,000 lives can be saved each year in the United States alone by achieving an artificial heart system. Such a system can be made widely available to humans by large-scale cooperation between both academic and industrial scientists and engineers. Similar efforts could provide artificial kidneys, lungs, and other vital systems for widespread personal use.

Information. As Vice-President Humphrey has pointed out, society is faced with an avalanche of new professional data that threatens to make most recently discovered information almost useless. Yet those who could make beneficial use of it may not even know that it exists.

This need for efficient handling of information is most painfully evident in the medical field, even though the U.S. Public Health Service has established a $3 million automated library known as Medlars, for Medical Literature Analysis Retrieval System. Every 2 weeks this system automatically indexes the world's published medical literature in a few hours. But no system yet exists for enabling hospitals and physicians to make automatic use of Medlars and similar aids. The Public Health Service has repeatedly warned that many thousands of patients suffer or die needlessly each year "because the knowledge gained from research is not fully used."

Lack of an automated research system has likewise slowed our courts, law offices, and legislators—although legal data systems are now operational in a few States and could be quickly widened with a major effort.

In fact, virtually every field of human progress needs to be systematized by wider use of automatic data reduction, literature searching, abstracting, and cross-referencing. Existing machines are doing such work, but links between them are still scanty. A nationwide system of cybernated libraries and remote-control data displays is needed to put current information at the fingertips of every researcher and administrator.

Already the Clearinghouse for Federal Scientific and Technical Information in Spring-field, Virginia, is providing needed data at high speed from more than 500,000 reports of work in the physical and engineering sciences. Dr. Stafford L. Warren, a member of President Johnson's scientific advisory staff, advocates a larger system—a National Library of Science, which would provide a central pushbutton storehouse from which all scientific information could be channeled swiftly to fact-seekers. Such a system is well within the present powers of American technology. Indeed, far more inclusive systems are now possible. One corporation has announced a memory device that could store inside a 6-foot cube all information recorded in books, reports, and publications during the last 10,000 years.

Rapid Transit. The magnitude of traffic congestion in many of our larger cities has begun to offer a sobering reminder of the transportation breakdown in ancient Rome, when Julius Caesar found it necessary to ban all wheeled vehicles during daylight hours. By 1970 it is estimated that nearly 140 million people—more than the total U.S. population at the end of World War II—will live in overcrowded metropolitan areas. Yet the last all-new rapid transit system in the United States dates back to 1907, when Philadelphia built its subways. Today, no technological breakthroughs are needed for systems that can vastly ease and expedite the movement of people and/or freight in the near future.

Surveys. Before any large, undeveloped region can be opened up, it must be accurately mapped. Not only its contours but its vegetation and subsurface materials, its conditions of wind and water, must be known. Only then can developers begin laying out roads, pipelines, powerlines, irrigation systems, mines, oil centers, and other improvements.

Until very recently, such a survey for even a small area has taken months or years. Huge undeveloped regions on every continent await the coming of modern technology, because reliable surveys have not been available. But now the means are at hand to provide such precise surveys at high speed.

Food. The world's population is estimated to be growing by 100,000 per day. Food and water crises in many parts of the world are forecast as early as 1970. New, more efficient systems for food production and water processing can avert these crises.

A British scientist wrote recently: "Bearing in mind the possibilities for promoting human well-being, making nitrogen fertilizers is the most underexploited chemical discovery of all time." Fertilization of present farm land would seem to offer the biggest and easiest single answer to the world's food shortage. Methods are available for this.

Methods are also available for converting sea water to fresh water—at near-competitive operating cost if the system is large enough—and for renovating polluted water for irrigation and industrial use, or even for drinking.

Many other human needs, of course, could also be met by current technology if public support were sufficient. There can be large-scale systems for reclaiming arid regions and eliminating water shortages, for protecting against weather disturbances, for suppressing forest fires, for improving the health of underprivileged groups, for improving the operations of educational systems and police departments, and for other immensely valuable projects of various kinds. Most of these, however, would probably require more time to make their benefits felt than would the systems mentioned for health, information, rapid transit, surveys, and food.

(d) *Assess the most effective means for channeling new technologies into promising directions, including civilian industries where accelerated technological advancements will yield general benefits, and assess the proper relationship between governmental and private investment in the application of new technologies to large-scale human and community needs.*

The channeling of new technologies into promising directions including civilian industries is being accomplished primarily by three avenues: (1) the publication of data generally in trade magazines, technical journals, and technical symposia; (2) the interchange of data under license agreements; and (3) the reporting of data by contractors to the Government which, in turn, makes these data available to other contractors who need them. The first and second methods are those normally followed by industry in our private enterprise system and need no particular additional support. The third method provides for a general use of data which emanate from Government-sponsored R&D work. The latter avenue, although indirect, is also a valuable method of spreading technical data. It is here that additional improvements could speed up the communicative process.

The sheer volume of technical data has made communication the principal obstacle in scientific progress. Any institution, public or private, which operates at the frontiers of knowledge has difficulty in finding and digesting the data available from all sources. Each organization may develop its own system for indexing the technical papers and other material on subjects of interest. North American maintains a Technical Reports Index that is published every 6 months, with monthly supplements. However, even governmental agencies attempting to operate their own catalogs are finding it impossible to incorporate on a timely basis all the major sources of data. The National Aeronautics and Space Administration is now attempting to establish a data retrieval system on a national scale. Some services within the Department of Defense are beginning to study the same subject. Many persons at work in this field assume that eventually the Government will establish a National Data Retrieval System attempting to incorporate all important data sources. Where unclassified data are concerned, even strictly commercial firms could be allowed to participate by subscribing to the system for a reasonable fee. North American endorses this principle, and believes that the pace of technological advance may be materially accelerated by such a system.

With regard to the proper relationship between governmental and private investment, we believe in the Lincolnian formula that Government should restrict its activities to those which cannot be done, or done as well, by private endeavor. Where a public need may be filled by private financing, this should be the proper method. Where the necessary investment would be too great for private companies, or where the return on an investment deemed necessary for the public good would not be sufficient to attract private capital, then some form of Government participation would be in order. We feel that the proportion of private-public investment can vary considerably according to the ability and interest of the former. But where it is clear that only the Government has the resources or the motivation to carry out an essential project, it should do so if the effort is supported by public policy. In such cases, the most efficient and economic method, proven by longtime American experience, is by contracting the effort to private organizations.

(e) *Recommend, in addition to those actions which are the responsibility of management and labor, specific administrative and legislative steps which it believes should be taken by the Federal, State, and local governments in meeting their responsibilities (1) to support and promote technological change in the interest of continued economic growth and improved well-being of our people, (2) to continue and adopt measures which will facilitate occupational adjustment and geographical mobility, and (3) to share the costs and help prevent and alleviate the adverse impact of change on displaced workers.*

The U.S. patent system has traditionally been a cornerstone of scientific and engineering progress and continues to provide both protection and incentive for the making and utilization of inventions. There is considerable inconsistency and some confusion as to the ownership and utilization of inventions emanating from Government-sponsored R&D work. This appears to devolve from the different practices of the various Government agencies involved as set forth in the Space Act, the Atomic Energy Act, policies of the Department of Defense, and various other specilized guidelines, such as the Saline Water Act. We believe that technological progress would be promoted if the United States could adopt a uniform patent policy for all such technical activities. This purpose is embodied in proposed legislation now before the U.S. Congress (S. 1809). We have recently expressed support for this legislation.

With respect to inventions developed in commercial enterprises, the President has recently appointed a commission to review our patent system and make recommendations for changes to strengthen and improve it.

With regard to the second and third parts of (e), we do no feel in a position to offer a substantive contribution in these areas, since our experience has not included a significant level of worker displacement due to automation or technological change (as indicated in our response to (b)).

STATEMENT

Prepared for the Commission
by the
Northwestern Mutual Life Insurance Company
Milwaukee, Wisconsin

Statement by the Northwestern Mutual Life Insurance Company

One Company's View of Automation

Introduction

For many decades life insurance companies have had to deal with volumes of paperwork which are quite large in comparison to other industries. This has prompted them to be among the pioneers in the use of each new device and technique for more efficient handling of data. Thus life companies have been early users of typewriters, desk calculators, punch card equipment—and computers.

The word "automation" is one of the newest in the English language. Perhaps it is also one of the least understood. The definition of the word itself is straightforward, but the scope of its application is beyond the comprehension of most of us individually. Although the dictionaries have acceptable definitions, one of the best is included in the proposed American Standard Vocabularly for Data Processing: "Automation—3. The investigation, design, development, and application of methods of rendering processes automatic, self-moving, or self-controlling."

The concept of automation in life insurance is included in that far-reaching definition. More specifically, however, automation in life insurance is almost entirely contained in that portion which is called electronic data processing. The life insurance is essentially a set of services represented by a wide variety and distribution of data in various forms. The computer is an ideal tool for this activity.

The following observations relate to the impact of automation, via the computer, on the Northwestern Mutual Life Insurance Company. In varying degrees they may be extrapolated to apply to other life insurance companies.

Impact on Employment

In any large, complex organization there are many concurrent forces at work which cause a measurable change in the aggregate, but which cannot be measured individually. So it is with employment in the life insurance company. Forces which tend to increase such employment include new products, extended and more prompt services, increased sales volume, more extensive reporting (whether internal or governmental), etc. On the other hand, forces which tend to decrease such employment include the reverse of those just mentioned—and the use of laborsaving devices and techniques. Over a period of years each of these forces will add its weight to the aggregate result.

There is no doubt that computers, through computer-oriented systems, have exerted a significant force on life insurance employment patterns. We have experienced this at the Northwestern Mutual Life, and we have observed it in the case of other life insurance companies. However, while the force was expected (during the days of the feasibility study) to be primarily toward the reduction of office staff, the new vistas of product and service opened up to us by computers have generated a strong force in the upward direction as well. The interplay between these two opposing forces, intermingled with other forces toward a better product and more intensive sales effort, creates a constantly changing picture.

But the significant conclusion which we must draw from our experience is that the combination of forces has served to increase the number of our employees. This is shown clearly in the following table which compares the most recent year-end (1964) with that of 1956, the last year before we began our major effort to utilize electronic data processing:

Employee classification	*No. of employees*		*Percent of increase*
	1956	*1964*	
Executive officers	14	14	0
Officers	71	88	23.9
Supervisors, specialists and attorneys	103	154	49.5
Office staff	1,217	1,265	3.9
Total	1,405	1,521	8.3

Perhaps these changes in number of employees will be more clearly understood when viewed in light of certain other measures of change in the company. There is no single indicator of the number of business transactions which take place in the course of a year, but the following figures provide something of a composite indicator:

Item	*1956*	*1964*	*Percent of increase*
Number of pieces of outgoing mail	5,154,000	7,660,000	48.6
Number of policies at year-end	1,595,000	1,712,000	7.3
Insurance premium income	$281 million	$380 million	35.2
Insurance in force at year-end	$8.4 billion	$12.7 billion	51.2
Net investment income	$127 million	$218 million	71.7

How much did automation through computers contribute to the increase in personnel—or how much more would the increase have been without computers in the picture? The forces of change are so completely interrelated that it is impossible to answer that question. Of course, it is possible to measure the number of jobs eliminated by the consolidation of several files over the 3-year period required for conversion of records. Similarly, it is possible to measure the number of jobs in the new division established to handle our Insurance Service Accounts—a payment service which was made available only through the use of computers. And there are other instances of clear-cut changes in both directions. But not so clear are such questions as: How much new business can be attributed to the better sales and service tools accorded by the computer to our agents? What would have been our competitive posture without computers as compared with other life insurance companies and with other savings institutions? How much of our continuing growth can be attributed to a better-informed management?

The comparative figures for 1956 and 1964 have other interesting characteristics. There was no change in numbers at the very top level of management, and there was a relatively small percentage change in the broad base of employees, the office staff. On the other hand, the middle managment and professional levels increased by a very significant percentage. Incidentally, a more detailed breakdown of the office staff also shows a higher job level than before on the average. This phenomenon reflects the increasing breadth and complexity of our life insurance product and related services.

The impact of automation on employment at Northwestern Mutual Life, then, is not easily determined. It does appear, however, that automation and other forces have combined to increase total employment by a fair number and to increase more responsible positions by a significant number.

A comprehensive study was made of employment patterns at Northwestern Mutual Life in 1963-64 by the Wisconsin State Employment Service. This study resulted in the April 1964 publication of "Automation Program Report No. 3: A Large Life Insurance Company Automates; Workforce Implications of Computer Conversion." A June 1964 supplement was entitled "Changing Workforce Characteristics of an Automated Insurance Company." Both of these publications were part of the U.S. Employment Service, Automation Manpower Services Program, Demonstration Project No. III.

Impact on Products and Services

No doubt the most important result of the use of computers at Northwestern Mutual Life has been in the expansion of our insurance product and related services. We have experienced a dramatic upward surge in the diversity of our product and in the amount and presentation of information to our customers, our agents, and our management. Again, there are corollary forces which have helped to prompt these innovations, and it took more than just the computer to implement them. But there are quite a number of examples which illustrate the unique contribution of computers.

The major innovation made possible only through computer-power is our Insurance Service Accounts (ISA). This is an account facility which permits an orderly series of payments to cover any number of policies with irregular premium due dates, loan interest due dates, and loan principal repayments. There are intricate interrelationships and complex calculations which bring together the processing of ISA records and of the corresponding insurance policy records. The prerequisites for this service include not only the computers and those programs specifically designed to handle ISA, but also a highly integrated computer system for our insurance records. The popularity of this new service is illustrated by the fact that in the short time since ISA was made available (less than 3 years), the number of accounts has grown to more than 57,000—including 10 percent of our 1,700,000 policies and 14 percent of our $13 billions of insurance in force.

Another example of improved service is our Premium Notice. The computer permits bringing together an assortment of related data, transforming this document into a combination "notice" portion and "your record" portion. About 10,000 of these are prepared each working day of the year. We have been able to show also the "past year increase in cash value" —the calculation of which would be completely impractical for the large volume of notices without the computer. Still another example is our Policy Service Card which gives the agent complete and current status information for each policy relating to his clients. About 18,000 of these are prepared daily to reflect the new policy status following current action, and the calculations involved are usually extensive. With this Policy Service Card, however, the agent can give immediate answers to most questions which life insurance clients ask about their policies.

Has the computer changed the basic contractual concept of life insurance? So far, it has not. However, the computer does offer a new capability for more sophisticated and more personalized forms of life insurance. The implications of this capability and the possible versions of a new contractual concept are being studied in many life companies. It is inevitable that this capability will be used, that the computer will change the face of life insurance. The years it will take to accomplish this are a reflection of the great complexities inherent in this fiduciary contract which must stand for decades.

Impact on Sales

The computer has been a friend to the life insurance salesman. It has provided him with an improved product, a happier client (with a very few, but vocal, exceptions), and a more efficient use of his time. This has been accomplished through a variety of powerful sales aids and servicing improvements. The agent now has at his disposal much more information, in a more useful form, in a shorter time.

Again, the computer's impact on sales is coincident with a variety of other forces, and it is impossible to isolate them for individual examination. There is no doubt in our minds, however, that the collective contributions made by the computer have materially aided our sales—which were up 17.3 and 12.7 percent in 1963 and 1964, respectively.

Impact on Management and Administration

This view of the computer's impact is in one sense simply a composite of the other impacts. But it is also more than that. By virtue of the new high level of data manipulating ability, elaborate and complex analyses can be made with relative ease. The manager potentially has at his disposal virtually anything he wishes to know about past performance and current status of the business. In addition he can obtain projections into the future based on the assumptions he specifies.

That description paints a far rosier picture than progress to date would justify. Most companies have barely scratched the surface of management reporting via the computer. Management is just beginning to understand the nature of the complex interrelationships which are the fiber of any corporate entity. As the computer makes available more extensive and more timely data, management finds that decisions are not easier—but simply much better informed.

At the Northwestern Mutual Life, the computer has been of material help in sales reporting, markets research analyses, studies of agency profitability, agent manpower projections, etc. We have high hopes in the areas of financial reporting, securities portfolio analysis, and others. The development of these activities requires a great deal of time—first, to establish the specifications of what management really needs, and second, to implement the systems effort demanded for their completion.

Will these developments ultimately reduce the number of managers needed? Conceivably so, but it is very doubtful that the demand for qualified managers will decrease. Managers must have an increasing awareness of a wide range of subjects in order to be effective. Commerce and other segments of our economy are becoming more and more complex. Products and services are rapidly expanding. The interplay between government and the private sector of the economy is becoming much more involved—both in the regulatory and in the tax aspects. All of these continuing changes will demand greater attention from management, and it seems likely that this upward influence is more than enough to offset the lower forms of traditional management activity which the computer might be able to encompass.

Impact on Organization

Perhaps it is worth a brief note to mention that the computer does have an impact on organization. It provides significant new ways for doing business, and this cannot help but have an equally significant effect on organization.

The nature of this effect varies greatly by industry and by company. At the Northwestern Mutual Life, the lower levels of organization have changed dramatically in three major operational departments, but the larger organizational structure is little changed. The latter circumstance may be attributable to a desire to assimilate the great operational changes before giving full recognition to their effect on basic organizational structure. Also, the essential functions to be performed in a life insurance company have not yet changed, even though the "mix" of people-activity and machine-activity has changed.

Impact on Costs

There is no doubt but that, at the Northwestern Mutual Life, the costs of doing business according to precomputer standards have been reduced. However, there is also no doubt that the postcomputer products and services, more elaborate and more useful to the consumer, are being provided at costs somewhat higher than before.

As we have noted several times, a wide variety of forces has interacted, and it is impossible to define the precise impact of each of them individually. It may be of interest, however, to compare the changes in salaries, in equipment costs, and in total personnel between the years 1956 and 1964 (before the computers arrived here, and the most recent completed year, respectively). For comparative purposes, these figures may be related to the indicators of company growth and activity shown above.

Item	*1956*	*1964*	*Percent of increase*
Salaries, wages, and benefit plans	$8,767,000	$13,210,000	50.7
Cost or depreciation of furniture and equipment	$ 186,000	$ 524,000	181.7
Rental of equipment	$ 174,000	$ 113,000	35.1
Total personnel at year-end	1,405	1,521	8.3

An evaluation of these comparisons must take into account several observations. First, it should be noted that this is not the whole story of costs. There are several offsetting cost considerations, most important of which is the reduction in "collection fees" in the agency offices. This item approaches $1 million per year, well over twice the increased annual equipment costs.

Second, we are well aware of the many additional complexities brought about by our improved insurance and annuity benefits and services. The Northwestern Mutual Life has been among those companies having an extremely high rate of change in this regard during the past 15 years. These new benefits and services have been received with unusual enthusiasm, and they have required the continuing attention of a significant number of qualified people. New equipment and new techniques have been adopted by most life insurance companies in one way or another and competitive pressures have caused the subsequent adoption in other companies to be widespread. In any event, this general consideration of improved benefits and services is probably the major reason that salary costs increased more rapidly than "total personnel." As the average levels of skill and responsibility have gone up, so too have salary levels.

Third, worthy of some note is the persistent increase in salary levels for the same job during this period.

In summary for this consideration of the computer's impact on costs, it may be said that costs would have decreased—were it not for that dynamic tendency of our economy to provide a bigger and better product for the consumer. The consumer's standard of living as it pertains to life insurance, and as in many other sectors of the economy, has been improved materially by the computer.

General Observations

A limited view of automation (and even of the computer) such as this must be qualified to show the larger context. Over and above its impact on one particular company is its impact on an entire industry. The life insurance industry has received from the computer much assistance in its efforts to retain its traditional share of the nation's savings dollars. What might have happened to life insurance during the past decade without the computer is problematical, but the larger companies felt great pressure on their systems and space capacities. No doubt solutions would have been found; however, the effect on the life insurance industry's competitive stamina must remain an unanswered question.

Beyond this discussion of the life insurance industry is the impact of the computer, and of other forms of automation, on many other industries. Each industry has its own peculiar characteristics and, hence, its own reaction to automation. Although there are a number of dramatic instances in which automation has reduced employment, the literature tends to indicate that they are distinctly the exception. It is our impression that in most industries time and progress have combined to offset personnel savings via automation with personnel requirements for expansion in volume and product line. Also, industry does try to ease the transition.

Beyond even the impact of automation on all industries existing at a certain point in time is the miraculous evolvement of new industries. These come about in a variety of ways:

1. The tools of automation must be dreamed of, designed, developed, manufactured, advertised, sold, distributed, and maintained. These functions create many jobs.
2. New technologies combined with the tools of automation make possible many important new products. The economy finds a strong market for these where no such market existed before. Sometimes old products are thereby made obsolete, but other times the consumer has acquired brand new tastes. Again, there are many functions required to transform these from ideas into consumables, creating many jobs.
3. The rising standard of living opens up a vast market for new services of all kinds—in recreation, entertainment, beauty aids, housekeeping aids, etc. Even if these services use the tools of automation, they create jobs and many times the service is one of skill not likely to be automated.

Not quite a new industry, but one which has been expanding rapidly, is education. Education and training have a tremendously important role in our somewhat automated economy. The very large amount of knowledge which must be transmitted is taking, and will continue to take, corresponding large amounts of "people-time"—both for teaching and for learning. The higher our standard of living and the more complex its components, the more time must be spent to understand any one of its facets. This is a growing activity with the end nowhere in sight.

An Estimate of the Future

In spite of the first decade of automation and in spite of the expanding job force, unemployment in the United States is at a relatively low level. In fact, some think that unfilled jobs exceed job seekers—because the skills sought are higher than those available. In other words, the free economy has demonstrated clearly that it can accommodate itself at least to the present level of automation. But what of the future?

Automation has two conceptual abilities—it can do certain things which have been done in the past by people, and it can do certain things which could not be done in any other way. The impact of automation in the future will be determined by the "mix" of these two abilities. The former releases people for other activity (or inactivity), while the latter provides a new network for all kinds of jobs which require people. The former makes existing products cheaper, while the latter provides new products —both serve to increase the consumer's living standard.

Those who view the future with predictions of very little work for human beings to do tend to look only at the examples of automation which replace people. They fail to recognize the vast capacity of the human being to consume new goods and services when they appear on the market even though the "need" for them was not recognized earlier. In this society, the most affluent in the history of mankind, we have visions of a future in an environment which requires astronomical expenditures of time and materials—ask any far-sighted city planner about what can be done to improve the living standard of the city dweller; ask any American (except perhaps one in 10,000 who is very wealthy) what additional consumables he could dispose of if given the opportunity. The potential market for even the existing varieties of goods and services in the United States is extremely high. Yet we are finding new consumables at an increasing rate. And there are parts of the world in which people exist at bare subsistence levels. With so much to be done in this world, let alone in space around us, there seems to be absolutely no doubt that people will have work--meaningful, productive activity—for many decades to come, if they desire it.

On the other hand, there are those who view the future as nothing more than an extension of the past, failing to take into account the acceleration of change that we are experiencing. The higher rate of change does tend to cause increasing disruption and dislocation in individual situations. These cannot be ignored because to do so would mean a gradual accumulation of wreckage—both human and material. The answer is simply that some small portion of the fruits of change must be used to clean up the debris of change. That is easier said than done because the fruits of change are most plentiful under a free economy, while the debris of change is often handled by a governmental effort. Also, it is not easy to distinguish between the debris of change and the debris resulting from incompetence and imprudence.

How can we enjoy the best of automation and at the same time minimize its problems? There is no sure-fire blueprint to guide us, but we do have past experience to help us. The subject is so broad, encompassing such an extensive range in the spectrum of our economy, that any general approach must be very general indeed. To serve as a point of reference, however, perhaps the following approach may be considered:

1. The people of the United States should reaffirm in every way possible through their elected governments the strong conviction that we have achieved our present level of progress only in a context of personal, political, and economic freedom. Of course, there have been appropriate constraints to ensure that the freedom of one does not subjugate the freedom of another. It should be their clearly stated objective, also, to maintain this context of freedom. A consistently high level of progress can be achieved only on such a foundation.
2. More specific to automation, the inclination toward research, experimental, and developmental activities should be encouraged. At the very least, they should not be discouraged by regulatory and tax policy. The cost of this phase of industrial activity is high, and research efforts are frequently unsuccessful. The reward for success must be sufficient to offset the prospect of failure.
3. Where a new use of automation is being explored to do a job previously done by people, the cost of conversion should include provision for retraining those whose jobs are terminated as a result. It will be difficult to find a practical and equitable means of doing this, but it does seem to be justifiable in concept. As a corollary, hiring policies of the future must contemplate a more extensive training program for new employees. This is particularly important for certain groups which find employment opportunities to be limited —e.g., high school dropouts.
4. Education and training—both public and private—must be a primary point of emphasis in the years ahead. This emphasis on the development of human resources is essential for doing today's jobs effectively and for adapting to tomorrow's changes readily. This topic was very ably summarized by Max Ways in "The Era of Radical Change", in *Fortune*, May 1964:

> . . . why [do] we need so much more organized communication than our ancestors had.
>
> The answer lies in radical change as a condition of life. Most members of a stable society absorbed almost unconsciously all they needed to know about the life around them. . . . With us it is otherwise. All parts of society are in motion and most men are in motion—changing jobs, changing residence, changing acquaintances, buying things they never bought before, confronting problems and seizing opportunities their fathers never heard of. In the radically changing society the connective tissue, the organized effort required to stay in touch, is enormous and every year will require a larger proportion of the total work.
>
> This need is the real basis for doubting that our grandchildren will have nothing to do when they grow up except chase one another around swimming pools.

Summary

Automation has had, and will continue to have, a profound effect upon employment patterns. If we are satisfied to forego future progress, automation can be used to decrease the employment requirements of the present stage in our economy. However, the more we progress, the more we see new fields to be conquered. Our horizons for ultimate human fulfillment are still virtually unlimited.

The nature of work will change gradually, it is true. The level of knowledge and skill required for an individual to make an effective contribution to society will increase. The pace of change will be rapid, but the problems will be no more than we are able to resolve—because in large measure we establish the limits of our own problems. Our major concern will be the wisdom needed to guide this fascinating course. We must maintain our desire for progress, and we must not tinker with the essential mechanics of it. We must give it "loose rein."

If we succeed in adapting to our changing environment, then human work, in the best sense that we know it, will continue to be an essential prerequisite for human progress. If we fail, there will be even more work to do—and it won't be nearly as pleasant.

STATEMENT

Prepared for the Commission
by the
Office Employes International Union
New York, New York

Statement by the Office Employes International Union

It would be a mistake to make comparisons between the industrial revolution, which created mass production industries and jobs, with the changes taking place today due to improved technology and automation. One of the purposes of the industrial revolution was to create jobs, while automation is specifically designed to eliminate jobs.

Thomas J. Watson, Jr., chairman of the board of IBM, in testimony before the Subcommittee on Unemployment and the Impact of Automation of the House of Representatives, stated in 1961:

> We seem to have automated our country sufficiently to supply all of the basic demands and a good many luxuries, and still involve only 93 percent of our work force. . . .
>
> We can't argue that technological change and and automation are not laborsaving processes. Of course they are. They do cause displacement of people. In fact, to do so is one of their major purposes. They may also upgrade people or increase the prosperity of an industry so that more are employed. Nevertheless, we do have more unemployment than we can tolerate today and some of it has come from technological change and automation.

Ralph Cordiner, chairman of the board of General Electric, in the same year before the same Committee, put it this way:

> If, in spite of the best planning we can do, some people are temporarily unemployed because of technological change, both industry and government have a recognized responsibility to help families through any such periods of transition.

On July 16, 1964, David Sarnoff, chairman of the board of RCA, in a speech dealing with the social impact of computers, stated:

> The reduction of work will apply not only to executives but in varying degrees to all echelons of our economic structure. Science and technology and the progressive refinement of automation will, in the next 20 years, justify the reduction of the workday to 4 or 5 hours.

Here, therefore, we have three expert representatives of management closely identified with the manufacture of electronic data processing machines and numerous other laborsaving devices agreeing that automation and technological change are eliminating jobs.

The experience of the Office Employes International Union throughout the United States supports the contention of these business leaders and of leading economists, social scientists, and other labor organizations. Routine clerical occupations are being eliminated at an alarming rate. The computer is also making inroads on certain technical occupations in addition to designers and draftsmen. Unskilled and semiskilled blue-collar jobs have diminished in numbers since 1956. This reduction will continue in years to come as the number of blue-collar workers relate to the total work force.

The Bureau of Labor Statistics forecasts that by 1975, clerical and kindred workers will increase by approximately one-third the current total of 10,900,000. These figures can be deceiving because they do not indicate the dramatic changes in the makeup of clerical occupations by the year 1975.

Another important factor would be the number of new jobs created in the coming years if automation was not a reality. Several years ago, the Bureau of Labor Statistics made a study of employment in the commercial banking industry, which indicated that without electronic data processing, employment in that industry would have increased by 600,000 workers by 1975. With automation, the projection indicates that only 400,000 workers will be added by that year. It is indicated that by 1970, banks with about three-fourths of all workers employed by banks will either have their own electronic data processing installations or utilize the services of computer centers. Studies in the savings banks field and the insurance industry reveal that the number of additional employees who would normally be hired without electronic data processing will be seriously curtailed because of the use of computers and peripheral equipment.

While large numbers of routine clerical occupations, such as file, sorting, inventory control, ledger, bookkeeping, and accounting clerks, and numerous others, will be eliminated in the future, the successor jobs, such as systems analyst, programer, computer operator, and console operator, will not provide adequate employment possibilities. Routine clerical jobs have always provided a break-in area for young people seeking permanent employment. Such beginner-jobs will no longer exist in the future.

Statistics indicate that by 1968 the average age of Americans will be 25. Millions of young people, the product of the postwar baby boom, entering the labor market in the coming years will create a dramatic change in the type of person seeking employment. It is difficult to understand how our economy can provide jobs for these young people in the foreseeable future.

There are approximately 70 million workers in the labor market today. We must provide jobs for 101 million workers by the year 1980. Labor, industry, and the Government must concern itself with counseling, education, and guidance of our youth. We must insure the fact that they are properly educated in the newer and more complex skills which are evolving from technological change and automation. We must prevent education and training geared for occupations which will not exist in the future.

The problems generated by automation and technological change cannot be met or resolved by labor, management, or the Government acting separately. The appointment of this Commission is a step in the right direction. However, we believe that this or a successor Commission will have to be given more than investigatory duties. Eventually, tripartite committees at the Federal, State, and local community levels composed of representatives of labor, management, and the government will have to be appointed in order to meet these problems in all of the geographic areas of our country. These committees or commissions, answering to a Federal commission, should be responsible for the promotion of technological change to insure full employment, economic growth, and profits. In addition to providing adequate training for workers in jobs which will exist in the foreseeable future, the Federal and local commissions will have to adopt numerous other measures to avoid an adverse impact on workers, business, and the community.

We believe some of these measures should be the following:

1. The use of unemployment insurance funds to transport displaced workers from areas of labor surplus to areas and industries where shortages of personnel exist. It is far better in our opinion to use some of our unemployment insurance monies for this purpose rather than to pay weekly benefits until they are exhausted.

2. Earlier retirement for all workers, with special consideration for women. Women now make up two-thirds of the work force of the United States. It is far more difficult for a woman in her forties or fifties to gain new employment than it is for a man in the same age bracket.

3. We also believe that unemployment insurance funds should be used for training and retraining of workers displaced or about to be displaced.

4. Special training centers should be established for workers advanced in age and not readily adaptable to the operation of automation devices.

5. Business should be encouraged to create on-the-job training programs for workers faced with displacement by technological change or automation. This type of training is always more effective and more readily understood by employees.

We feel that our companies and corporations should provide an educational program for boys and girls in their senior year in high school whereby these young people can both attend school and work in order to acquire various office skills. This is being done on a limited basis in various parts of the United States at the present time and is highly successful.

6. Unemployment insurance benefit payments should be made more realistic, and such payments should take into consideration the time required to train workers displaced by automation or technological change. In effect, therefore, our unemployment insurance system should be made more elastic in order to meet more realistically the peaks and valleys of our economic system.

7. A shorter workweek must be established.

Automation and technological change have produced a spiraling of profits produced by tremendous increases in productivity. At the same time, we are faced with the fact that 5 percent of our work force is unemployed. The future indicates that our employment problem will get worse rather than better. Those who oppose a shorter workweek are refusing to face reality. The course of American industrial history shows that the workweek has been cut approximately 3 hours per week per decade since the turn of the century. Unions through collective bargaining have already cut into the fast fading 40-hour workweek. Actually, more than 8 million workers in the United States presently work a basic workweek of less than 40 hours; 62 percent of office employees in the northeastern part of the United States are working a weekly schedule of less than 40 hours.

Automation in the factories and the offices has and is boosting production far beyond the increases obtained through mass production in the 1920's; thus a drastic cut in the workweek is essential. If we do not cut the workweek through Federal legislation, we must resign ourselves to the fact that millions of workers in the United States will be unemployed and will be supported by Federal funds produced through taxation of those employed and through profits created by business.

Even today, millions of people in America are weekly recipients of foods which are defined as surplus under American farm legislation. If we do not produce a full employment economy, we will find ourselves faced with having to give away free a large percentage of the output of American industry.

It is our feeling that a Federal commission should also consider the feasibility of the use of certain automation devices. Computer manufacturers seem to be competing with one another for purposes of producing speeds of operation which are no longer realistic. We now have computers operating at speeds far beyond our needs. Numerous banks throughout the Nation, for example, are able to perform all of their services in their electronic data processing installations within a matter of a few hours. As a consequence, they are now competing with one another and with computer centers for the services of companies and corporations in order to be able to make full use of the computers.

We cannot help but wonder whether or not there should be more control over the use of automation where its capacity is greater than the work for which it was originally intended. Possibly, instead of control, an educational program for executives in need of automation information is a must. In certain utilities, for example, where there is no existing competition, does it benefit our society to automate jobs out of existence, particularly when it appears that savings are not passed on to consumers?

STATEMENT

Prepared for the Commission
by
Radio Corporation of America
New York, New York

Statement by Radio Corporation of America

Statement of the Problem

Automation is now widely recognized as a significant means of accelerating the entire industrial process. It offers rapid and increasingly economical means for performing repetitive tasks, routine decision making, and control functions, and for handling information accurately at extremely high speeds.

While the long-range benefits of automation are generally acknowledged, its short-range dislocations have provoked spirited controversy and given rise to concern among workers and their families.

In essence, the problem is one of adjustment. How can our industrial society adapt most effectively to the far-reaching changes which automation is bringing about in our national economy and social structure?

In the whole broad range of domestic problems, this one stands out as distinct and different—in its immediacy and complexity, in its economic challenge and social impact, in its compelling demands on our vision and leadership. In considering the problem, many factors are involved.

Perhaps the most important of these is the fear of massive unemployment. Will the higher productivity resulting from automation be translated into unemployment instead of into higher living standards? Responsible leaders have given voice to such fears. Other spokesmen have countered with statistics to demonstrate that automation has actually spurred employment. It has been pointed out that without automation, the coal industry would long ago have succumbed to the competitive thrusts of alternate power sources. In the midst of these conflicting viewpoints, one statistic is reassuring. Over the past few years, with automation gaining wider acceptance throughout industry, the overall unemployment rate, instead of rising, has actually decreased.

Another factor bearing on the problem is labor mobility. What can be done to encourage displaced workers to move to other geographical locations where job prospects are more promising? Is it desirable now, as some have suggested, to provide funds that would enable workers to respond to changing opportunities? If so, where does the prime responsibility rest for taking the initiative in this matter?

A third factor is the question of retraining. Would it be feasible to establish a nationwide system of training allowances? Under such a system, displaced workers might be paid for going to school and preparing themselves to move into upgraded positions in an automated industry.

A fourth factor is the growing impact of foreign competition. How, without widespread automation, can the United States offset the lower labor costs of Japan, West Germany, and other countries, and still maintain its competitive position in the world economy? Western European nations already are well along the way to automating their factories because their need for output in greater than their present labor force can produce. If they automate more rapidly than we do, will they not acquire a decisive advantage in the international marketplace?

A fifth factor is the rate of our national economic growth. How much of an increase in the growth rate could be achieved with, say, a 10 or 20 percent step-up in automation? Is the extensive application of automated techniques to industry and commerce a requisite for continued rises in our living standards?

Automation and the Electronics Industry

The electronics industry is both a source and a beneficiary of automation. In the first place, much automatic equipment is electronically controlled, providing the means of replacing human judgment and control. Electronics provides the sensing devices, the means of communication, and the computing devices for complex automated systems.

In the second place, mechanized processes are used in the production of electronic equipment. In assessing the impact of automation upon the electronics industry, this statement will confine itself to experiences of the Radio Corporation of America.

Technological Change at RCA

The role and pace of technological change at the Radio Corporation of America has been gradual rather than dramatic and it appears that this will continue. For example, even though the equipment used in the manufacture of electron tubes has been mechanized over the past 15 years the number of assemblers has continued to rise with the growth of the business.

The steady growth of this business and the development of more sophisticated types of tubes and other components have led to the creation of more complex electronic systems. The increased use of electron tubes in computers and television, for example, created the need for other components such as semiconductor devices and tiny integrated circuits, which, in turn, stimulated new areas of business and offered additional employment opportunities.

It has been RCA's experience that as business has grown in terms of gross sales, employment has also grown in spite of the gradual introduction of more efficient technology. It is anticipated that this relationship will continue. During the past 10 years sales have increased 70 percent while employment has increased 34 percent.

Job Requirements and Worker Displacement

In terms of types of workers, there has been a change. During the 1950's hourly-paid (production—unskilled and semiskilled) employees represented approximately 60 percent of the employee population, while now in the 1960's they represent approximately 45 percent of the population. Increases have generally been in more highly skilled occupations, such as in the engineering, technical, and administrative areas.

The effect of this change appears to have already been recognized by business, education institutions, and the Government. Newspapers, Government literature, and other media have described the situation in such statements as, "Employment opportunities exist for the well-educated, but opportunities are diminishing in the less complex and less intellectually demanding occupations."

Many programs supported by the Government and the private sector appear as possible solutions to this problem. For example, industry's aid to higher education—scholarships, grants, fellowships, tuition-refund programs for employees—and Government programs aiding the colleges and universities will increase the numbers receiving college education and advanced degrees. As this effect is felt, the grossly undereducated and underprivileged now being helped through the antipoverty and MDTA programs should be capable of assuming the unskilled and semiskilled occupations presently held by people with college potential.

Recommendation for Support of Advanced Education

Great effort and much money is being spent on the antipoverty program and MDTA. It would appear that an equally aggressive effort should be made in urging and supporting college attendance. Unless those with college potential complete higher education and accept more intellectually demanding positions, there will be no places available for the antipoverty and MDTA graduates.

In other words, the grossly undereducated and underprivileged and those with college potential must all be elevated together at the same time. More emphasis should be placed on the college prospect through counseling, financial support, and subsidy, or the Job Corps graduate who cannot compete will find little employment opportunity.

Recommendation Regarding School Systems

Changes of great impact are characteristic of industry, the Government, and many other institutions. It appears that the institution least affected by new theories, concepts, and technology is the school system. An unwillingness to accept new educational ideas and methods contributes significantly to the dropout problem, lack of motivation, and inferior education.

A number of new concepts are being formulated that deserve wider consideration; for example: (1) an examination plan which would give credit for knowledge already assimilated whether or not through the formal classroom allowing the student to graduate sooner or take other courses; (2) computer-aided instruction; and (3) less mechanized programed instruction devices. More is known about motivation and learning theory than is being practiced in the usual school system.

An aggressive program of training and retraining of teachers appears needed. A national task force to study and recommend new standards and concepts of education at all levels seems extremely desirable.

Recommendation Regarding Direction of Government Programs

It appears that the Government programs—antipoverty and MDTA—have not fully utilized the skills of industrial training directors. Since the educational success of these programs will be judged in terms of the graduates, it may be well to have guidance from industrial trainers. Competitive forces have required industrial trainers to develop and utilize more sophisticated learning devices than any other group in vocational training and education.

It is recommended that industrial trainers be represented on local and national committees considering the problem. Some consideration should be given to an arrangement with industrial companies to release highly skilled trainers to the Government on a year's leave-of-absence basis.

While the foregoing discussion is by no means exhaustive, it does include points that are important and relevant to RCA's experience in adapting to changes created as automation is introduced on a rising scale.

It should be recognized at the same time that there is a risk of attributing to automation or technological change dislocations that result from other causes, such as a shift in consumer demand. The problems of dislocation are the same, whatever the cause, and they are certainly not to be underestimated. However, blaming automation for all of our social and economic problems is more likely to hinder than to help in determining the rate at which we should proceed.

In the long run, if the growth trends of the United States prove adequate, the economy should be able to absorb the results of increased productivity without appreciable disturbance. When the national economy is on the upsurge, automation can be effected with relative ease. During a period of economic softness, the tensions of transition are magnified.

It therefore becomes essential to direct intensive analysis to the problems of growth and to formulate procedures which will promote adequate growth. One way to advance growth is to stimulate the creation and development of new industries. The Government can help substantially in this respect by providing proper and adequate incentives.

STATEMENT

Prepared for the Commission
by the
Retail Clerks International Association

Statement by the Retail Clerks International Association

We welcome the opportunity to state our views on problems of technological change to the Commission. The Retail Clerks International Association, which now has a membership of approximately 460,000, has always been concerned with the work conditions affecting employees in the retail trade. Our constitution specifies as one of our objectives the elevation of the moral, intellectual, and social conditions in the trade, and it is clear to us that technology has a serious impact on these conditions.

We do not propose, in this statement, to discuss the many issues that flow from technological advance in general. Rather we wish to limit ourselves to the developing situation in retailing. It is frequently said that where human services predominate, automation is impossible. Yet, as we view the current scene, we discover that computers with feedback mechanisms, as well as electronic data processing, are increasingly utilized in this area, just as in manufacturing, public utilities, mining, and elsewhere. As retailers become aware of the possibilities of these techniques, engineers come forth with devices that can be used directly in merchandising itself.

Today, all sorts of flexible automatic loading devices and materials handling equipment are beginning to appear. In retailing and distribution, the outstanding developments are found in prepackaging and automatic handling of materials at both the warehouse and retail level. Once these devices are connected with data processing equipment, automation is firmly established.

Naturally enough, the introduction of automated equipment first reveals itself in larger enterprises. Elaborate systems of conveyors, ferris wheels, pallet lifts, and monorails, frequently linked to computer systems, are being installed in department stores and supermarkets, thus demonstrating that retailing is catching up with industry in the use of advanced methods for the handling of goods.

One of the impediments that retailers need to overcome is the lack of sufficient flexibility in some of the mechanical systems. Department stores, particularly, stock thousands of items in containers of varying size, shape, and weight. Nevertheless, goods handling has been perfected in a number of department stores and specialty operations permit merchandise to be moved through conveyor belts and monorail tracks from the delivery platform to the selling floor, all governed by computer controls.

These advances can be described as automation, for they fall into the category of process redesign and control of operations. The underlying conditions of mass purchasing power, relative labor scarcity, and high operating costs are well known. In retailing, these factors are supplemented by the existence of suburbia, mass transportation, refrigeration, and an industry which has exhibited a steady growth pattern since 1950. Increasingly, the human response in retailing is being eliminated and electronic connections are being substituted.

These installations are not costly. The fact is that computer systems of various sizes are available to firms in the retail and distribution field which do not require heavy investment and expensive equipment. Allen Harvey of the Dasol Corporation remarked some years ago that small firms can readily reap the benefits of automatic data processing. He stated that virtually any concern can install a system involving computer equipment that will satisfy its specific needs and at the same time be economically feasible.

Here are some of the advances now being made: Shoe chains are adopting data input devices at the point of sale; cash registers create a punched tape which records details of every transaction; variety chains are working on ordering systems based on a universal code which identifies each item, involving print punch tickets; drug store chains are installing computers for merchandising purposes; department stores continue to experiment with point-of-sale devices; apparel chains are using computers in merchandising and inventory control and in preparing documents relating to charge accounts; mail order concerns utilize computers to control warehouse inventories and to produce order-picking sheets and store invoices; food chains are experimenting with installations which produce punched paper tapes representing the daily order of perishables so that the data can be transmitted by wire to the company's regional distribution center; and a number of retail concerns are putting into operation merchandise control and reordering systems based on the use of full sized punched card systems.

Automatic reorder techniques utilizing computers have decided advantages for the retail chain in that they save much labor and also provide more balanced stocks; more business can be done with less inventory. Of course, these techniques can be applied more easily to small staple lines that include a wide range of sizes, styles, and colors and that have a high turnover rate. But it is rather difficult to apply the automatic computer system to bulky goods, high fashion lines that change rapidly, seasonal goods, or slow turnover departments. Yet areas involving model changes can be made amenable to computer systems as illustrated by the numerical control system in the machine tool industry. Similar principles can be applied to retailing. Of course, some managements do recognize that there is a certain cost in the impact which these systems have on human beings that must be taken into account. Said one management expert, quoted in *Chain Store Age*, January 1958:

> The danger of push-button merchandising lies in the fact that the chains can lose their merchandising talent at the store level. Automatic reordering takes the fun out of work for the salesgirls. People like to feel that they are in control of an operation and even making mistakes is beneficial because it gives them a sense of importance. When you get too automatic you get restless or listless help. The salesgirl's planning instincts become dulled from disuse. She becomes so accustomed to ordering automatically that she loses the ability to plan for future seasonal and fashion peaks.

Yet, at store equipment exhibitions, labor-saving devices usually capture the enthusiasm of retailers. As often reported in trade journals, equipment is now available to weigh, label, and compute the price of merchandise by electronic methods. There is cellophane wrapping machinery for prepackaging eggs; tracking equipment to enable the vertical stocking of items such as detergents, beer, soda, and other heavy and bulky merchandise; power-adjusted wrapping machinery for prepackaging meat, fish, poultry, and produce; a meat-chopping device featuring a double-grind process which, in a single operation, can reduce the needed number of man-hours by 60 percent; automatic machinery to wrap and label meats in a single operation; industrial sweepers for warehouse and parking lot use, as well as a variety of other devices.

The backroom in the supermarket is, of course, a most important area for improved materials handling. The trend to mechanization is most evident in the handling of nonperishable items. Equipment to speed the flow of stock from truck to shelf has been gaining widespread acceptance among food chains. While conveyor systems of both the gravity and power type have been used in single-level and two-level stores for many years, the trend is for more automatic installations. Full conveyor systems are now in use in which the line of flow of merchandise is along the most direct line from the truck to the shelf. Alternate flows are built into the system so that the stock may go to a holding area until needed and then to the price-marking station.

Supermarkets are also using the pallet or platform loading system more extensively. Full loads of stock of one item or of items for one section are loaded on wooden pallets in the warehouse and placed aboard a trailer by forklift trucks. At the store they are unloaded by another forklift and the stock is then trundled to its holding bin in the backroom. Sometimes the pallet is taken directly from the truck out to the sales area for price-marking and stocking. Supermarkets are installing overhead rail systems for unloading and transporting sides of beef, more power equipment for cutting, grinding and shaping, more highly powered automatic and semiautomatic wrapping machinery, and more scales which automatically print the price on the package. Linked up to these devices are both power and gravity conveyor systems. Wrapping machinery accelerates the mechanization of the various departments and such machines often require a linked-in materials flow system to keep up with their wrapping capacity. Much of this heralds the beginning of an automated operation, for what is utilized here is the principle of the transfer machine linking disparate operations. Tie a computer into the operation and we have automation.

The backrooms in supermarkets, where fruits and vegetables are prepared for display, are being more highly mechanized. At work stations trimmings fall into automatic disposals. Cases of produce are set securely into given positions reducing handling to a minimum. The produce workrooms are being styled in the manner of meat department work stations, with wrapping materials, trays, heating irons, and hot plates carefully arranged for maximum efficiency. Movable racks are used which will hold a dozen or more trays of produce, while in other systems conveyors carry packages behind the produce racks. In some stores, sliding windows have been introduced into refrigerated produce racks, enabling the merchandise to be stocked from the backroom in the same manner as meat is stocked in the wrapping rooms.

As a consequence of these developments, dairy department backrooms frequently have to be provided because of the new equipment introduced in other departments. Actually a dairy backroom is part of the display itself, since the new cases and curtains which allow customers merely to reach for the merchandise are made so that the backroom stock is directly behind the sales display. As customers remove merchandise from the display the stock clerk merely slides new products into position from behind. In order to mechanize the operation, however, belts are being introduced so that a new item is brought forward automatically when one has been removed from the front.

What is important to note is that these devices feed on each other. The trend toward more prepackaging of produce, for example, leads to more mechanization in the steps both preceding and following the packaging operations. This, in turn, leads to larger departments with a relative increase in storage and preparation areas. And, in turn, this creates a need for more materials flow equipment. This, perhaps more than anything else, is the most significant thing in mechanizing retail operations. One step produces another, and in the end human beings become less important in the conduct of business.

Such streamlining and mechanization has paid off quite well. One supermarket installation in Minneapolis makes the fullest possible use of laborsaving machinery. It is air-cooled at 65 percent humidity and employs a sales staff of seven men and four women. While the company has not provided any figures on the extent of laborsaving resulting from mechanization, this particular store uses the same size work force as a market with approximately two-thirds of its volume. Trade journal commentators, while stressing the gains in efficiency secured from mechanization and automation, are not adverse to pointing to the laborsaving that stems from the installation of new equipment.

When these mechanical devices are linked with electronic control systems, we create the possibility of establishing a completely automated retail establishment in such a way that the customer will be able with a minimum of effort to place her order, have the merchandise delivered to the front of the store, and pay her automatically computed bill. In fact, such a system has been proposed by the International Telephone and Telegraph Company and is intended primarily for chains of 150 stores or more, all of which would draw merchandise from a central warehouse. The system can transmit orders, say, for 37 cases of eggs, 96 bunches of bananas, and a half ton of instant coffee which are delivered automatically to the store. The orders are transmitted at the store into a telephone. While the sounds are not intelligible to the ear, they are automatically decoded and fed into a printer and card punching machine or calculator which then goes to work gathering the order. The system can be linked to a data processing computer so that orders coming in from all stores may be totaled.

In November 1959, the General Telephone and Electronics Company announced a machine that can be placed at supermarket checkout counters where it will read or scan fluorescent stickers on each grocery item as it passes on a traveling belt. This information is passed to a computer which totals the customer's purchases. Such an automatic checkout operation takes about two-thirds the time now required for manual handling by checkout clerks. Automatic checking thus speeds customer flow, provides more accuracy in totaling orders, and supplies an automatic reorder system for the warehouse. The scanner is connected to the cash box, where a similar device enables the electronic reader automatically to record prices of the individual items at the checkout. Problems of handling items selling for prices in combination, such as 3 for 29¢, are solved by having the device renumber the first two items at 10¢ each and ring the third at 9¢.

According to the spring 1959 issue of *The Journal of Retailing*, a department store in 1965 may look somewhat like this: The customer walks through an invisible curtain of air and passes from the 95 degree (Fahrenheit) temperature outside into the 75 degree temperature inside. She then takes an automatic elevator to the sixth floor, where she goes to the housewares department, which operates on a self-service basis with checkout counters. Selecting a coffeemaker from a display counter, she takes it to the checkout stand, deciding to purchase it on credit, have it delivered, and charged to her account. Unknown to her, the sales register receives authorization for the credit sale (as a result of the cashier putting her authorization plate in a special slot in the register) and sends complete information about the transaction back to a computer, which updates her account and includes her purchase in all sales and stock control reports being currently compiled of the day's business.

Our customer of 1965 boards another operator-less elevator and goes to the first floor. She stops at the men's furnishing department on her way down and buys a shirt for her husband from one of the vending machines which sell the fastest moving sizes, color, and brands of men's shirts. She again makes a credit purchase by placing her authorization plate in the special slot.

> This action on her part causes all information concerning the transaction to be electronically relayed to the sales unit, accounts receivable, and stock control departments. On the way to the garage, where her car is parked, she stops in the lobby of the entrance to the store and purchases a pair of hosiery from a vending machine which takes her currency and returns her change.

This is the store of the future. Completely automated systems eliminate many of the cash registers, shopping carts, and expensive fixtures; they reduce the size of supermarkets and reduce the size of inventories; they end the need to price-mark individual items and will drastically reduce the number of workers required.

In the supermarket area, all that seems necessary at this time is for one of the giant chains to undertake such an installation and to accustom the public to its use. This does not seem too difficult a public relations task. When supermarkets were first started, customers were unwilling to purchase prepackaged meat and insisted on seeing the butcher at his work. This problem was solved by the late Lansing Shields of the Grand Union Company by moving the butcher workmen out from the backroom closer to the selling area to do his job behind a glass window. Gradually the housewife became accustomed to prepackaged meat and today one seldom sees the butcher at his work. Prepackaged meats are placed in attractive displays and counters and the housewife is quite content. Personal relationships, once thought so necessary to the success of a retail operation, are being reduced to a minimum, if not entirely eliminated.

One of the major problems in supermarket operation is the tendency for customers to queue up during peak-hour operations at the checkout counters. To help solve this problem, one concern is experimenting with an automatic packaging machine at the checkout counter. As the customer approaches the checkout clerk and places the merchandise on a conveyor belt, the clerk adjusts the machine for the size of the order. While the order is checked on the register, the merchandise is placed into a loading bin with light and fragile items on the top. As the loading bin is filled, the cashier presses a button and the bin pushes the merchandise into an open bag, which is then lifted onto a receiving platform while the bin reopens to accept a new load of merchandise. Should it become necessary to resack a heavy grocery order, either at the customer's request or because of injury to the bag, the automatic bagger can do this in less than 10 seconds by merely reloading the filled bag into the loading bin and starting the machine which automatically does the job of repackaging. Equipment of this type not only increases productivity in the sense of speeding up the flow of merchandise through the checkout counter, but also eliminates the need to have an extra employee to do the bagging. Such a device can be easily linked to electronic data recording and processing equipment for inventory and sales records.

Even change-making is being mechanized. Clearly, with the development of automatic vending machines, the possibility of completely automated retail stores is virtually upon us. For a long time, growth in automatic vending was limited by the lack of a reliable machine to handle paper money. After years of work, the Atwood Vacuum Machine Company of Chicago developed a device which, when presented with a dollar bill, delivers 2 quarters, 3 dimes and 4 nickels in change. The Atwood device operates by holding a bill in a perforated screen under a photoflood lamp and then electronically reading the amount of light passing through the perforations. It can be adjusted to accept denominations other than a dollar and deliver any combination of change.

Said *Architectural Forum* of December 1958, in discussing retail automation:

> It is too early to say what all this will do to the ranks of service workers, currently the most sharply rising sector of U.S. employment, thus far almost untouched by automation. It may someday pose a problem of no mean dimensions.

In the light of these developments, it is not unwarranted to assert that retailing is an area in which jobs can be simplified and made routine so that electric computers can replace the worker entirely or permit one worker to do the jobs of several. Obviously industries, or even parts of industries, do differ with regard to the extent to which automation can be applied. But in materials handling and in retailing, the range of application appears to be a fairly broad one.

We are told that job retraining, unemployment insurance, and diversification can help workers adjust to this new situation. Skills must be directed toward repair and maintenance, instrument reading, and the like. Abilities will have to be of a higher level. But the question still remains whether room will be made in the retail industry for the development of the semiskilled technicians required to operate the new equipment. Certainly the impact of automation here would be lessened if there were actually an upgrading of jobs. Certainly it is desirable that the "humanization of work," which many predict will stem from automation, should not be impeded.

The trade unions recognize that there may be long-run gains stemming from automation. They know that progress in improving standards of living has been possible because of increasing knowledge and increasing productivity. The latter, measured in terms of value added, has increased roughly 3 percent a year or, in constant dollars, 62 percent between 1947 and 1960. There was, according to Bureau of Labor Statistics data, a 17 percent rise in man-hours in retailing. Deflating output by man-hours input reveals a 38 percent growth in retail productivity over the 13-year span; virtually 3 percent per annum, a record that certainly is as good as anywhere else in the economy. There is no denying the fact that automation will markedly enhance these trends.

Yet we must call attention to the fact that successful adjustments to automation is a long-term process and that the immediate impact does raise serious social problems. The immediate short-run welfare of individual workers can be threatened by the haste to automate every process and every technique.

We cannot agree that automation moves slowly. In the retail field, recent developments have turned it into a veritable flood of change. The effects of automation are important enough to require national attention. Automation was unknown in retailing not too many years ago, but now it is increasing in application and in intensity.

Rapid technological change can disrupt the lives of individuals and we must urge that thought be given to programs for reducing the harmful effects of the new technology. Perhaps automated devices ought to be introduced carefully, in accordance with some schedule, so that the individual worker in retailing and distribution will be protected against adverse effects.

True, automation does have ancient roots, but recent developments in automating retailing represent a new force which has imposed upon the industry the need to revise time-honored techniques of merchandising and, more significantly, has altered substantially the traditional relationships between management, labor, and the public. Retailing indeed is in a state of revolution. No longer can one identify given merchandise lines with given types of retail outlets. Everyone sells everything. This is not only a matter of mere merchandising; there is no question but that automation too has played an important role in making possible the striking changes that have occurred in the retail industry.

STATEMENT

Prepared for the Commission
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Statement by Julius Rezler, Loyola University, Chicago

The Impact of Automation on American Unionism and Its Possible Consequences

This paper addresses itself specifically to identifying the impact of automation on the various areas of production and employment (point (b) in the Commission's inquiry).

It is believed that unions as representatives of the labor factor in the political and economic scene are both directly and indirectly related to production and employment. Therefore, anything which would cause major changes in these areas would, at the same time, have a derivative effect on unionism, too. This is clearly recognized by union leaders who are anxiously appraising the possible consequences of automation for unionism. According to a recent survey, union leaders have unmistakably indicated that among the contemporary issues they are primarily concerned with the latest phase of technological change, generally known as automation.[1]

The purpose of this statement is twofold: First, it is going to register some important economic trends resulting from the emergence of automation which have possible bearings on the growth and structure of American unions; second, the possible consequences of such changes for society, industrial relations, and the worker will be evaluated.

Trend 1: Persistent shifts in the industrial and occupational composition of the labor force

Changes in the industrial composition may be summarized: The shares of manufacturing, mining, and transportation in total employment have been declining in the past 10 years, while the relative shares of the so-called service industries, such as government, trade, finance, etc., have been growing.

What is the meaning of these changes in the relative employment of the major industries for unions? The industries with declining shares in total employment are by far the most highly unionized areas of our economy, while labor organizations have experienced little success in organizing the growing service industries. In 1962, around 63 percent of union membership were employed by firms in manufacturing, mining, and transportation. Further decline in the relative employment of these industries would slowly erode the traditional basis of union organizing.

Changes in the occupational structure of the labor force have even more ominous meaning for the unions than the shift in the industrial composition. A secular trend which manifests itself in the upgrading of the labor force has been accelerated and reinforced by automation. As Kassalow noticed, "Somewhere along in the 1950's the United States ceased to be a nation made up primarily by industrial blue-collar employees . . . it was around 1956-57 . . . that the number of white-collar employees in the labor force begain to exceed those in the blue collars."[2] Between 1955 and January 1965, the share of the so-called white-collar group in total employment has increased from 39 to 45.6 percent, while the relative share of the blue-collar group has declined from 39.2 to 36.3 percent of the total civilian employment. A continuation of this trend is projected by students of the labor market.

The implication of the above development for the labor movement becomes clear when the occupational composition of union membership is considered. In 1962, 87 percent of the unionists belonged to the blue-collar groups, while while-collar workers represented only 13 percent of union membership.

The combined effects of the previously discussed shifts in the industrial and occupational composition of the labor force tend to erode slowly but surely the traditional organizational basis of American unionism. The repeal of Section 14b of the National Labor Relations Act would probably reverse the trend in the contraction of union membership—but only for the short-run. The additional members resulting from the elimination of the legal ban on the union shop would still come from the blue-collar occupations, and with the shrinkage of this group, the present trend would sooner or later catch up with the unions.

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[1] Barkin, Solomon—A.A. Blum, "What's to be Done for Labor? The Trade Unionists' Answer", *Labor Law Journal*, Mar. 1964, p. 177.

[2] Kassalow, E.M., "New Union Frontier: White-Collar Workers", *Harvard Business Review*, Jan.-Feb. 1962, p. 41.

The only way in which the labor movement could counteract this trend would be to replenish the vanishing blue-collar members with a mass organization of the ever-growing white-collar employees. With the exception of a few optimists, however, American labor economists are unanimous in their diagnosis: There are almost unsurmountable difficulties in the way of mass unionization of the clerical, technical, and professional work force. Scores of studies have recently investigated the social, psychological, and economic factors which stubbornly operate against the success of present labor organizations among these occupational groups. Their identification with management, the large portion of women employees among them, the low prestige of contemporary unionism, the enlightened personnel policy of most corporate management are among the main reasons for which the chances are rather slight that the present organizational patterns might be changed radically.

Trend 2: Decline in the size of the average factory work force

Labor savings is one of the principal goals and major consequences of automation. In an automated plant the original work force may decline from 10 to 80 percent, depending on the industry and the degree of automation.

Such reduction of the average work force basically affects both the size and the composition of the bargaining unit. But the reduction in the size of the work force will usually result from a decline in the absolute number and relative share of the production workers. The number of maintenance and technical employees generally either remain at the preautomation level or even increases.

Naturally, such a development would have a definite effect on the formation of the bargaining units. At present, it is not quite clear whether the above changes would promote or hinder the formation of a single bargaining unit which would include the whole blue-collar group in the plant. Experts list some factors which may cause a conflict of interest between production and maintenance workers, and could lead to separate bargaining units; at the same time, some other factors are recognized which might promote the unity of the two groups of workers.[3] However, if the average bargaining unit in an automated plant is already reduced in size due to the general labor savings effects of automation would be further weakened by the formation of separate units for the different groups of factory workers, a considerable loss in the economic strength of unionism at the plant level would result. There may be some exceptions from this rule in particular situations. Raskin points out that sometimes not the size of the bargaining unit but its strategic position is what matters.[4] But in the great majority of the cases, a contraction of the bargaining unit would weaken the position of the union vis-a-vis management.

Trend 3: Movement of the production facilities from the industrial centers to rural and small town areas

Industry in the era of mass-production technology relied heavily on industrial centers for adequate labor supply, and therefore its facilities were located mainly in the densely populated metropolitan areas. Automation, however, has decisively changed this pattern for two reasons. First, for its labor savings effects, it has reduced the labor requirements of the automated firm to such an extent that the relatively small work force necessary for operation may easily be available even in low labor supply areas, such as small towns or rural communities. Second, the movement of plants away from the industrial centers has been facilitated by automation because, as pointed out by James Stern, "Automation accelerates the obsolescence of existing factories and thereby hastens the dispersion and decentralization of modern industry to the less industrialized areas of this country." [5]

This geographical movement of industry is going to have profound effects on unionism. First, it works against the so-called proximity factor which is generally acknowledged by the students of the labor movement as being one of the essential preconditions of union growth. "The hard cores of labor movements all over the world have existed from the very beginning in the so-called industrial centers where hundreds of thousands of workers are employed and work side by side." [7]

Whenever automation facilitates the relocation of old plants and the construction of new plants away from the industrial centers, it not only neutralizes the favorable effects of the proximity factor, but also puts two major roadblocks in the way of union organizing in the new areas. It sometimes makes the costs of organizing prohibitive, and increases the financial burdens of unions just at a time when income from membership dues begins declining. E. C. Mattern, organizing director of OCAW, remarked that "it costs just as much to organize 100 men as it does to organize 500 . . . as a result the cost of bringing in new members has at least doubled over the past 6 years." [8]

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[3] Beal, E.F., and E.D. Wickersham, *The Practice of Collective Bargaining*, R.D. Irwin, 1959, pp. 610-611.

[4] Raskin, A.H., "The Squeeze on the Unions", *Atlantic Monthly*, Apr. 1961, p. 58.

[5] Stern, James, in *Automation and Major Technological Change*, The Industrial Union Department, AFL-CIO, Apr. 22, 1958, p. 12.

[6] *U. S. News & World Report*, June 17, 1963, p. 72.

[7] Rezler, Julius, "Union Growth Reconsidered", Kossuth Foundation, N.Y., 1961, p. 11.

But the financial burden of organizing in small town areas is the lesser evil of the two. It is more disturbing for union organizers that they must operate in an indifferent or even hostile environment when attempting to enroll workers of plants which are located in small communities. James Stern observed that in the rural areas "the traditions of unionism are not firmly entrenched and, in fact, very little is known about actual accomplishments or even of the existence of the union itself. . . . In an organizing campaign, therefore, the union representative must start from scratch. He has the task of not only persuading potential members of the rightness of self organization but also of acquainting them with the history . . . and objectives of the union. . . ." [9]

But indifference due to ignorance is still better than outright hostility of the community toward unionism. This is frequently the case, particularly in the southern rural communities, a segment of rapid industrialization. Under such conditions, the union organizer faces unsurmountable difficulties.

The retarding effects of recent plant movements due to automation have been recognized not only by union leaders but also by management representatives. G. G. Mitchel, manager of industrial relations at Du Pont, noted with some self-satisfaction: "The comparatively isolated locations of many of these plants undoubtedly has allowed us a better opportunity to put our employee relations philosophy into practice than has been the case with many of the so-called basic industries operating large plants in highly industrialized communities." [10]

Trend 4: Changes in job content and creation of new industries

Beginning with the first industrial revolution, technological progress has constantly eliminated or changed existing jobs and industries and created new ones. This process has been quantitatively and qualitatively accelerated by the growing application of automated technology to industry. Already in 1955 Dr. Brunetti listed 23 new types of jobs that have been created by automation and he contended at that time that this list constituted only a small portion of the new jobs resulting from automated technology.[11] A Department of Labor publication describes 13 basic occupations opened up recently in the field of data processing.[12] The pages of the *Occupational Outlook Quarterly* are full of references to entirely new jobs created by the various types of automation.

Experts agree that this trend will further aggrevate an age-long problem of American unionism, generally known under the term jurisdictional disputes. Killingsworth concluded: "New kinds of jobs will probably increase jurisdictional disputes, not only between unions, but between groups within unions." [13] Daniel Bell is even more pessimistic in evaluating the consequences of automation for inter-union relations: "With the rapid changes that have been taking place in automation . . . the whole question of union jurisdiction has become a complete crazy quilt." [14]

A further centralization of the union movement may result from an increase in jurisdictional disputes. The American labor movement has probably learned its lesson about the unfavorable effects of such disputes on the public and the government and will do its best to bring them to a quick settlement. This would inevitably lead to an expansion of the authority of the federation as an umpire over the affiliated unions. Braunthal suggests: "It is obviously easier to solve such problems where the authority of the national trade union center is strong enough to mediate effectively between contending unions. . . ." [15]

Trend 5: Decreasing dependence of the firm on the nonsupervisory work force in maintaining the continuity of production

This trend is caused by two related effects of automation. First, the size of the group of production workers in relation to both the total work force of the firm and the quantity of its production has been on the decline. Second, most of the functions previously performed by this group which made them indispensable for maintaining the continuity of production have been more or less taken over by automated equipment. As a consequence, the relative importance of the production workers to maintaining continuous production appears to be declining.

Both developments should reduce the efficiency of the concerted actions which have traditionally been used by unions to back their economic demands. The economic strength of unions in the organized industries and companies have largely been based on their ability to withdraw temporarily the supply of nonsupervisory work force, particularly the production workers, from the firm and thereby bringing the production process to a complete halt.

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[8] Quoted by Shils, E.B. in *Automation and Industrial Relations*, Holt, Rinehart & Winston, 1963, p. 176.

[9] Stern, *op.cit.*, p. 12.

[10] Rezler, Julius, "Labor Organization at Du Pont" *Labor History*, Spring 1963, p. 190.

[11] *Automation and Technological Change*, Hearings before the Subcomm. on Economic Stabilization of the Joint Economic Comm., 84th Cong., 1955, p. 385.

[12] *Occupations in Electronic Data Processing Systems*, U.S. Dept. of Labor, 1959.

[13] Killingsworth, C.C., "Automation in Manufacturing", *IRRA Proceedings*, 1958, p. 32.

[14] Bell in *Automation and Major Technological Changes*, *op. cit.*, p. 7.

[15] Braunthal, A., "The Trade Union Movement Faces Automation," *International Labour Review*, Dec. 1957, p. 556.

A. H. Raskin has paid particular attention to the effects of automation on strikes. He concluded: "When push buttons and electronic control devices regulate every operation . . . a handful of nonunion supervisors and clerks will be able to keep acres of machines producing in the face of a total walkout by unionized factory crews."[16] He lists some of the industries in which the strike weapon already lost its former effectiveness: "Changing technology already has made some industries almost totally invulnerable to union shutdown. Notable are the Bell Telephone System and the electric utilities, now so automatic that nothing short of sabotage or mechanical failure can disrupt their operations. The huge oil refinery and chemical plant of the Shell Oil Company in Houston maintained normal operations for a full year in the face of a solid walkout by its 2,000 unionized employees."[17]

Mr. Beirne, the president of CWA, appears to be in agreement with the prognosis of Mr. Raskin. He stated: "In many industries it's getting harder and harder to strike against the new technological machines that run automatically whether we work or don't work."[18]

However, if due to the above effects of automation, unions cannot any longer achieve their goals by strike or other concerted actions against a firm or an industry, there will be a radical change in the methods used in collective bargaining.

Broader consequences of the effects of automation on unionism for society, industrial relations, and the individual worker

If the trends analyzed previously would not be arrested soon, a decline in the overall strength of the labor movement could readily ensue. This process, in turn, would have some serious consequences not only for the unions themselves but also for the national politics, industrial relations, and the individual worker.

National Politics. In the past three decades organized labor has been among the main factors of the American society which have shaped our national politics. Therefore, any change in the relative power of the trade unions would also affect their role in the national power structure. J. Raffaele noticed: "Effective power in the American economy is shared among managers, labor leaders, politicians, government bureaucrats . . . it is beginning to be apparent that what is loosely called automation is already affecting the tone of industrial leadership and modifying the relative influence of its component parts."[19]

The direction of change may be projected by recognizing the present role of organized labor in national politics. According to political scientists and practicing politicians, unions as a whole have played an important part in fostering liberal policies in general and progressive legislation in particular. Therefore, if the overall strength of unionism would suffer from the various effects of automation, the liberal wings of both parties would lose one of their staunchest allies in the political arena, and consequently, the country would experience a general shift to the right.

Industrial Relations. A long-term decline of union power, however, would have its farthest reaching consequences for industrial relations, the primary area of union functioning, particulary in the automated sectors of the economy.

At present, there are two schools of thought in evaluating the possible effects of automation on the relative power of unions in industrial relations. The first school contends that a general decline in the numerical strength of unions will not seriously affect their power at the bargaining table. Kassalow argues that "a relatively smaller, well-unionized blue-collar force might have even more leverage than it has today if it represented only 50 percent of labor costs and 40 or 50 percent of the work force. . . . Such, after all, has been the 'We can be a bottleneck' kind of rationale characteristic of some craft unions."[20]

Buckingham and Gross have come to similar conclusions. They both refer to the fact that automation requires a 24-hour operation of the productive equipment, and therefore, management would go far to avoid costly interruptions. Buckingham further feels "that because of the declining weight of labor costs in total production costs and additional savings from automation, management might more easily accept the demands of unions than before."[21]

The second school of thought on the relative power of unions in industrial relations believes that the expected decline in the number of unionists, particularly in the mass production industries, would indeed reduce the bargaining power of labor vis-a-vis management. Albert Blum states: "Collective bargaining may only have limited utility—a utility which has been lessened by the impact of automation."[22] Raskin feels that labor's strength is already on the downgrade.[23]

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[16] Raskin, *op.cit.*, p. 56.

[17] Raskin, A.H., "Problems of Collective Bargaining in a Changing Technology." *Labor Law Journal*, Nov. 1962, p. 934.

[18] Quoted by Raskin, *ibid.*

[19] Raffaele, J.A., "Automation and the Coming Diffusion of Power in Industry," *Personnel*, May-June 1962, p. 29.

[20] Kassalow, *op.cit.* pp. 44-45.

[21] Buckingham, Walter, *Automation*, Harper, 1961, p. 147.

This writer agrees with the second school for the following reasons: Two important effects of automation appear to neutralize any advantages for unions resulting from the so-called "need for continuous operation" and "the bottleneck situation."

First, automated equipment enables management to maintain uninterrupted production with supervisory personnel if this is required by the existence of a strike. Second, as a consequence of plant movements to areas indifferent or hostile to unionism, the entire bargaining unit which might have constituted a bottleneck could be eliminated.

If those labor economists are right who foresee a decline in the bargaining power of unions operating in automated industries, then a radical shift in the power relations between management and labor might take place in favor of management in the near future. Since a power vacuum cannot exist for long. As soon as unions are forced to relinquish their former postions, management would take over unless the Government would throw its power to the support of the unions to enable them to maintain the present status quo in industrial power relations.

If the latter development would ensue, the pattern and concept of American unionism would necessarily undergo a basic change. Unions whose power is more or less based on active Government support would qualitatively differ from unionism as perceived in the American society today. Such unions would be recognized as an extended arm of the Federal Government.

Individual Worker. The individual worker who is involved in an automated production may, in many ways, be affected by the new work environment created by automated technology.

Here we are only interested in those effects of automation on the worker which would result from a weakened trade union movement. To reach certain conclusions, it is assumed that the participation of workers in strong trade unions increases their feeling of power and security vis-a-vis their employer and their self-estimate, and promotes industrial democracy. On the other hand, a declining labor movement would leave the individual worker without the feeling of protection and security, and thus would further the process of alienation of the worker from their work.

Acording to Robert Blauner, powerlessness is one of the main types of alienation in an industrial work situation. In his opinion, this form may be caused among others by the inability of the workers to influence general managerial policies, and by the lack of control over the conditions of employment.[24]

Wherever a strong union exists, the workers, at least in theory, are able to influence indirectly certain managerial policies, particularly in the area employment, and gain considerable control over the terms of their employment through collective bargaining. Therefore, the ebbing strength of unions in the automated industries may reverse the former process, thereby causing the phenomenon of alienation in the nonsupervisory work force. There is no need to go into detailed discussion concerning the possible psychological and social effects of this phenomenon. Here only the possibility of such development is indicated.

In conclusion it may be emphasized that a generalization concerning the impact of automation on American labor organization would be quite erroneous. Although a continued numercial decline of the American labor movement as a whole would affect not only its own prestige, political power, and social status but also those of the component unions, changes in the economic power of the individual unions would greatly vary with the degree of automation prevailing in the respective industry or occupation. The bargaining power of unions representing employees of nonautomated industries would suffer little, if at all, while labor organizations in the automated or semiautomated industries will experience increasing difficulties in achieving their objectives at the bargaining table. This is, however, only a preliminary observation, and further research should be focused on collective bargaining in various industries in order to find out the difference between automated and nonautomated industries in this respect.

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[22] Blum, A.A., "Labor at the Crossroads," *Harvard Business Review*, July-Aug. 1964.

[23] Raskin, "The Squeeze on the Unions," *op.cit.*, p. 55.

[24] Blauner, Robert, *Alienation and Freedom—The Factory Worker and His Industry*, Univ. of Chicago Press, 1964, pp. 16-21.

STATEMENT

Prepared for the Commission
by
Standard Oil Company of New Jersey
New York, New York

Statement by Standard Oil Company of New Jersey

We believe that the problem being studied by the Commission is important to the national interest. Consequently, we are pleased to present some observation based on our experience, particularly over the past 8 years:

1. The role of technological change has been and must continue to be a fundamental of American industrial life in both domestic and international terms of reference. Technological change can produce only a positive impact in the long run. The short-run problems that it creates must be met and solved, and not be accepted as a reason for attempting to block the change itself. As a business organization, we continually face the necessity for change and work to create the most affirmative attitudes toward change despite some obstacles at times.

2. We recognize that these changes can create serious economic and social problems. Industry, government, and labor share a heavy responsibility for seeking solutions to these problems. Fortunately, though, many industries have achieved remarkable degrees of success in technological change by innovation, experimentation, and real cooperation between the parties. We believe American industry and labor should build upon these constructive experiences in meeting future problems and accommodating to change.

3. Within our own organization, automation per se has not been the prime mover in creating the downward shifts in employment in times of rising production. These shifts have been away from the blue-collar occupations and toward professional and technical personnel. Production workers have undergone marked changes in job design, including upgrading of skills, increased flexibility of use, job enlargement, and cross-craft mobility. New methods, new organizational concepts, and persistent cost consciousness in the face of intensified industry competition have all contributed to the productivity gains and have in our own particular case been a far more significant factor than automation alone.

4. It is difficult for an individual company to predict broad-scale changes in the composition of the U.S. labor force. However, our company experiences suggest demands for more education and the long-term trend toward professionalization of the labor force. Capital intensive industries such as oil cannot be expected to provide any significant expansion of employment. We see no lessening of the need for manpower efficiency in our industry.

5. Recent measures that we have taken to provide for adaptation to technological change may be of some interest. Recent manpower surpluses in our company have necessitated the termination of a sizable number of employees. We have sought to minimize the adverse impact of our actions in a number of ways. To the extent feasible, we have used natural attrition, coupled with retraining and transfers and voluntary early retirement programs with supplemental pensions to reduce employment. Approximately two-thirds of the reduction in our work force was achieved by these means. Where layoff was necessary, employees were given sizable severance payments. An effort was made through advance planning to give such employees adequate early warning of impending termination. Many of the employees facing termination were also given brief training courses in the best ways to seek outside employment, and in a number of instances we found jobs for them in other companies.

6. In consideration of our recent experience, we believe that investments in manpower efficiency deserve the careful consideration of American management. Such investment can produce the economic tools that facilitate change with the active cooperation of labor and with minimum adverse effects upon people.

STATEMENT

Prepared for the Commission
by
Socony Mobil Oil Company, Inc.
New York, New York

Statement by the Socony Mobil Oil Company, Inc.

The comments which follow are lettered to correspond with the five statements from the mandate to the Commission:

(a) *The past effects and current and prospective role and pace of technological change*

We believe that the current changes resulting from advancing technology are simply a continuation of the industrialization process that has been going on in our country for many years. In spite of the frequent assertion that the rate of change is increasing, the facts indicate that the rate, as measured by rise in productivity, has continued in recent years at roughly the average for the past 50 years. This is not to deny that advancing technology does have initial displacement effects on some workers, some individual enterprises, and on occasion some industries.

Our present economically privileged position is due in large measure to our technological leadership. Because of the rapidly increasing competition from the other developed countries of the world, the maintenance of our economic position in the future will require maximum exploitation of accumulated technology.

(b) *The impact of technological and economic change on production and employment*

In Socony Mobil we are experiencing changes in the work force similar to those which have been reported on a broader scale for our economy by the U.S. Department of Labor. The number of blue-collar fixed-rate employees has been decreasing in petroleum industry. At the same time, the need for personnel such as operations research analysts, engineers, computer programers, and financial analysts has been increasing. We expect this trend to continue over the next 10 years. Overall, we expect that 10 years from now there will be about as many employees in the petroleum industry as there are now.

Although the overall result of technological change is a benefit to society in general, the temporary loss of employment for some individuals is a very real and tangible problem. To the extent possible, Socony Mobil is seeking to resolve through its own efforts the dislocation of its employees resulting from efficiency improvements in our work processes. Among the programs we are relying on to accomplish this are the following: within-company transfers, retraining of employees for other jobs with the company, tuition-aid for retraining of employees who wish to prepare themselves for jobs with other companies and other industries, outplacement counseling services to employees rendered surplus, termination allowances, early retirement, and assistance to communities in which operations are discontinued.

(c) *Areas of unmet community and human needs toward which application of new technologies might most effectively be directed*

We are sure that our Government representatives are more competent to identify the most significant unmet community and human needs. We would suggest that careful attention be given to enlisting the aid of private organizations in meeting these needs wherever possible instead of relying on Government programs alone. We would suggest that the Federal Government study the current experiment being conducted in California where the State has asked four private organizations to study and recommend solutions to four community problems.

In order to promote rapid technological change and cushion the impact of this change on individuals, we need to provide more and better educational and training opportunities for individuals and we need to increase the mobility of the work force.

(d) *The most effective means for channeling new technologies into promising directions*

The creation of new values for society has always involved a large element of risk. The business corporation has demonstrated through its effective application of technology that it is probably society's best institution for taking risks and marshalling the resources and talents needed to provide the goods and services most people want. The motivating force responsible for the effectiveness of the corporation has been our free enterprise system based on profit.

We are convinced that the business corporation will continue to be society's most effective means for channeling new technologies into promising directions as our society grows more complex. In the future, as in the past, Government can make its greatest contribution by creating the climate in which business can function effectively to create goods and services by taking risks.

(e) *Specific administrative and legislative steps which should be taken by Federal, State, and local governments in meeting their responsibilities*

We think government should not try to slow down the process of technological change or to spread work by shortening of the work week or by higher penalties for overtime work. Government should seek to promote the expansion of the private sector through reciprocal trade agreements which are favorable and incentive tax programs which spur the development of new plants and modernization of old plants.

In respect to increasing the mobility of the work force, government should make every effort to develop more and better labor market information in general and job vacancy statistics in particular. Government should also improve its programs for providing training opportunities for individuals as well as testing and counseling services. In addition, government should provide as economically and as efficiently as possible, financial assistance to cover relocation expenses of unemployed individuals who can find employment in other locations, and living expenses for unemployed individuals who are qualified for, and desire to take, training for new jobs.

STATEMENT

Prepared for the Commission
by
Swift & Company
Chicago, Illinois

Statement by Swift & Company

Technological change has contributed greatly to the economic growth and expansion of employment opportunities in this country. It is true that with technological change there are some dislocations and adjustments required. In some cases, out of such readjustments there have been some hardships, such as temporary unemployment, which are a matter of concern to both union and management. Insofar as these short-run changes have been reflected to some extent in unemployment in recent years, the question becomes, "How much unemployment is due to technological change?" Ewan Clague, former Commissioner of Labor Statistics, has said that no precise answer to this question may be possible, because employment results from various factors, such as declining demand and output, competition, labor savings machinery, and product substitution, among others. These factors may operate simultaneously and yet affect different parts of the economy and different industries in different ways.

The other side of the question, i.e., how much of the increased employment has been due to technological change, would likewise be very difficult to appraise and come up with any precise answer.

Product substitution can also be viewed as a technological change, and yet for those of us in industry as private entrepreneurs, this kind of change is one of the normal characteristics of a competitive situation.

In our own industry, the change that has occurred over a period of time has shown up in terms of both the number of employees in the industry, the shift in slaughtering facilities away from terminal markets, and sharp changes in the product mix over time. Some of these are the result of such technological changes as the extensive use of mechanically refrigerated trucks to replace the old-style ice bunker railroad cars. Both in the procurement of livestock and in the distribution of meat products, this kind of technological change has occurred over a long period of time and has caused shifts of employment.

Other changes in technology that have taken place include such innovations as on-the-rail dressing, which permits synchronized dressing of beef carcasses from a suspended moving carcass instead of on the old floor or bed arrangement. More recent improvements include the mechanical hide stripper, which reduces slaughtering floor labor requirements. With respect to changes in product mix, the tendency towards consumer packages has permitted the adoption of automatic packaging and continuous processing methods which may have increased employment.

Within Swift & Company, both the numbers of meat packing plants and numbers of sales units in our distribution system have markedly changed over a period of time. The numbers of employees have declined, with the peak employment occurring in approximately 1956.

Let us discuss for a minute the methods of cushioning such change. In the normal seasonal and cyclical flow of the industry, layoff and recall and turnover unemployment have occurred for year and years. Some of the methods with which we have met them have been prescribed arrangements for layoff and recall. In addition, early pension, deferred pension, separation pay, and transfer arrangements in the event of plant closings have been adopted.

It appears to us at this time that it would be most difficult, possibly reaching beyond the point of diminishing return, to attempt to measure or sort out the changes which are associated with technology and automation, changes due to shifts in location of the industry, and changes in the product mix or output of the industry.

STATEMENT

Prepared for the Commission
by
The Equitable Life Assurance Society of the United States
New York, New York

Statement by The Equitable Life Assurance Society of the United States

The Equitable, like other life insurance companies, uses electronic data processing equipment quite extensively. We are committed to still more extensive use as rapidly as we can get the developmental work done. Hence, although we are in a position to comment on only a limited area of your study, hopefully the points that follow will be useful as an indication of how we at the Equitable see some of these matters.

Our emphasis in the introduction of electronic data processing equipment has been directed almost entirely at reducing the huge paperwork and recordkeeping activity that represents by far the largest element of cost in the operations of a life insurance company. We have wanted to be able to absorb increasing volume and increasing complexity without a corresponding increased clerical staff, and primarily, but not entirely because of EDP, we are succeeding in doing this. It is, of course, competitively a necessity to maintain costs at the lowest levels compatible with a high quality of policyholder service; we also consider it a major obligation of a mutual company to provide its policyholders with insurance at costs which reflect the most efficient administration possible.

While our work along these lines necessarily results in the elimination of a substantial number of jobs, we have assured all of our people that, as a firm matter of company policy, no employees will be discharged because of the introduction of EDP. In the aggregate, growth of our business and our normal rates of employee turnover are together much more than adequate to absorb the displacement due to EDP. For specific individuals whose jobs are affected, we find appropriate jobs elsewhere in the organization after careful consideration of their particular experience and capabilities. Our EDP activity has therefore caused no external displacement, and will not under any now foreseeable conditions.

We do recognize, of course, that EDP has had an external effect in the sense that without it we would have to be hiring more new clerical workers. On the other hand, we are hiring many more people for planning and technical work than before, and both our needs and the levels of opportunity for such people are growing rapidly. The combined effects, by comparison to where we would be without EDP, are essentially: (a) a smaller total staff, (b) a reduced proportion of people in the lower skill levels; and (c) a higher proportion of people in the technical and planning levels where a much higher order of intellectual ability is required.

As we turn in the future to greater use of computers in more sophisticated assistance to management roles, we expect to find an even greater increase in the need for highly trained personnel with advanced educational backgrounds. A comparable trend is anticipated with respect to managerial personnel themselves.

Since the implications of much of this are in the direction of more employment opportunities for those who are capable of undertaking work calling for intellectual skills, and fewer for those who are not, it seems inescapable that ways must be found to apply the new technologies to the improvement of our Nation's basic education procedures. We hope that this will be one of the avenues of exploration given particular attention by the Commission.

STATEMENT

Prepared for the Commission
by
The Prudential Insurance Company of America
Newark, New Jersey

Statement by the Prudential Insurance Company of America

The Prudential is a life insurance company which started in business 90 years ago. Over these years, both the size and complexity of our business increased manyfold and the need for technological advance in the handling of statistics and calculations became apparent at an early date. A multitude of records must be accurately maintained for our many millions of policyholders, and we process many thousands of transactions for these policyholders on each working day.

For many years our accounting records were maintained in large handwritten ledgers. The advent of punch card sorting and tabulating equipment was an important development for the company. This innovation enabled us during the 1930's to convert many of our handwritten files to punch card files and to perform some simple machine calculations. The result was to benefit our policyholders by keeping the costs of administering our business under reasonable control. This period of mechanization of manual accounting procedures through the use of punch cards and mechanical accounting equipment continued in the Prudential throughout the 1940's and 1950's. During this time, our company continued to grow both as to volume of business and number of employees.

During the mid-1950's electronic data processing equipment (EDP), became available to private industry. EDP made it possible to further mechanize and consolidate our files, and to increase significantly the number of calculations performed by machine. As a result, the past 10 years have been a period in which we have converted most of our accounting work to systems which use modern computers. At the same time, we have begun to make advances in using these computers not only for routine accounting procedures but also to assist in the performance of more complex analytical functions. Again, during this period of time, the company's business and size of staff increased.

Since the mid-1950's, when we began our installations of electronic data processing equipment, computer technology has progressed so rapidly that we are again confronted with the need to modernize our administrative system. During the next 10 or 15 years, we will further reduce the size and number of our files by transferring information to more compact storage media directly available to the computers. An increasing amount of the operational detail of our business will be written into programs for our computers. In addition, we will be able to couple these computer advances to modern communication and technology. The result will be lower costs for our policyholders and more rapid, more efficient, higher quality service for them and for our agents.

As has already been indicated, there have been a series of technological advances in our business over the last 35 years. During this time there has been a growth in the number of our employees, and we expect to continue to be a growing company in a growing industry. However, automation has caused changes in the nature of the jobs that our business offers. There are fewer routine filing, recordkeeping, and calculation-type assignments, and an increased number of jobs offering more challenging work at higher levels. We expect this trend to continue.

Whenever the job content changes as the result of the introduction of new machine systems, it is our practice to absorb all affected employees elsewhere in the company. Often this results in retraining and in more interesting, higher-paying jobs. It has always been and is our policy not to discharge or demote employees because of technological innovations.

The advent of the computer has unquestionably increased not only the general level of the work of our employees but also their need for educational attainment. We have recognized this by conducting various management training seminars and workshops and by encouraging our employees generally to advance their formal education. Further, as a corporate citizen we are aware that this need extends beyond our own company, and in recognition of this Prudential last year cooperated with five other local corporations and the Newark Board of Education in setting up a work-study program for high school dropouts. A special school to help these people meet the requirements for a high school diploma was set up, and the students spent alternate weeks in school and on jobs provided by cooperating firms.

Prudential is also participating in a project designed to prevent students from dropping out of school for financial reasons. Newark companies make available afternoon work so long as students continue their regular schooling in the morning. As part of another program, our Building Service Division trained machine-shop helpers last summer. All those who completed the training were able to find jobs with local firms.

In summary, although much progress has been made over the years in all the areas described above, we feel that in our business we are only beginning to realize the possibilities of automation with respect to benefits in the form of improved products and services for the public. It will continue to be our objective to keep pace with the growing needs for insurance coverages in our expanding population and economy and to adopt improvements due to new advances in automation, but always with due regard not only to the interests of our policyholders but also to our responsibilities to our employees.

STATEMENT

Prepared for the Commission
by
United Air Lines
Chicago, Illinois

Statement by United Air Lines

We shall confine our answers to the impact of technology, automation, and economic progress to the air transport industry, and particularly United Air Lines. Specifically, the effect has been as follows (identification letters correspond to your mandate):

a. The airline industry has been characterized by rapid and far-reaching technological change since its beginning 40 to 50 years ago. We now find ourselves faced with the supersonic aircraft which will have further impact.

b. Undoubtedly, there will be illustrations of worker displacement because of both technological and economic changes; however, we believe that there will be no necessity for cutbacks in total employment. In fact, Stewart Tipton, president of Air Transport Association, recently estimated that between now and 1970 there will be an increase of 50,000 additional workers needed by the airlines. The major changes which will thus occur in our industry can be handled by retraining of personnel presently on the payroll and by the selection of qualified new personnel.

c. We are not cognizant of any areas of unmet community and human needs resulting from the application of new technologies. In fact, as our industry has grown, we believe that we have met the needs of the businessman as well as the vacation traveler for safe, dependable, and economical transportation. We have also contributed materially to the national security.

d. As we enter the supersonic era, we find that our industry is unable to raise the staggering sums of money required in the development of these airplanes without the assistance of Government. Most observers, both within and outside the industry, believe the development and production costs of these new machines will be beyond the capabilities of the private investment community. In order for America to remain competitive with European countries, it will be necessary for our Government to subsidize the air transport industry with several billions of dollars for the development of supersonic equipment.

e. Other than the measures discussed above regarding retraining and assistance in financing supersonic equipment, we believe the air transport industry can handle the problems arising from changes in technology, automation, and economic progress without the support of governments. Our industry is, we believe, very conscious of the human relations aspects of change, for we have seen the impact both upon workers as well as our customers.

Although these are very general, they do represent our faith in the ability of both our industry and the communities in which we operate to solve the problems of advancing technology in air transportation without any adverse effect on our Nation.

STATEMENT

Prepared for the Commission
by the
United Federation of Postal Clerks, AFL-CIO
Washington, D.C.

Statement by the United Federation Of Postal Clerks, AFL-CIO

The United Federation of Postal Clerks, AFL-CIO, regards the establishment of the Commission and its broad mandate as a major forward step of great historical importance in shaping future national policy.

We welcome the invitation to contribute our views to the Commission's deliberations because we too are concerned with the problem of alleviating inequities and dislocations arising from automation and related technical progress.

At the same time we are hopeful that the age of the computer heralds a new era in human relations.

Just as the industrial revolution brought about deep social change that ultimately produced modern capitalism and a vast new middle-class, so the technological revolution can bring about equally radical change with a new leisure class status for the American worker. The implications and ramifications of such change are, however, barely more visible to most Americans at this stage than present-day capitalism was to Adam Smith.

But our union also believes that a phenomenon so vitally important to human welfare cannot be permitted to grow and develop in an atmosphere of laissez faire. Our society must avoid the evils that accompanied the old industrial revolution.

That is the crux of the problem.

Society, insofar as it is represented by the entrepreneur, has always been more directly concerned with immediate gain than with moral responsibility. It has always been thus; it will be so again unless we do something about it.

Already there are danger signals: the accumulation, for example, of that ineluctable 5 percent or hard-core unemployed who have been discarded by the cutting edge of automated machines and mechanized assembly lines.

Another example is provided by a recent magazine poll which showed a majority of corporation officials endorsing as basic "management principles of automation" such statements as these:

> The company is entitled to all of the savings from mechanization.
>
> We are not obligated to compensate mechanization-displaced workers.

Charles Dickens wrote novels about people who had similar views of their social obligations under early capitalism.

But something more than literary gadflies will be required to insure that the technological revolution is built upon a moral foundation—by this, in social terms, we mean a human foundation.

Such a revolution must serve humanity. It must provide the greatest good for the greatest number.

Government has the major role in providing that insurance—and we use "government" in its broadest sense to cover national, State, and local bodies, regional groupings, and even the industrial "governments" of labor and management.

But the primary role belongs to the national government. That role was spelled out last May at the Anglo-American-Canadian Conference in Ditchley, England, on the impact of automation and technological change on trade union interests and policies, when the delegates concluded that

> Whereas Government in many cases may find it necessary to stimulate technological progress, it must also maintain the responsibility for seeing that the burden of the ill effects is not borne by any one group but is shared by the entire economy.

The Ditchley delegates also pointed out that while

> Government should be concerned with the long-range effects of technological change, it should also be aware of its short-term impacts both favorable and unfavorable. Steps should be taken at the earliest possible moment to minimize any potential ill effects as well as to ensure the security and enhance the welfare of both the employes directly affected and of society as a whole.

In this connection, they foresaw the need for governmental initiatives in at least four areas: (1) stimulation of demand to ensure the maintenance of full employment; (2) retraining of the work force affected by automation; (3) mandatory advance notice of redundancy to workers affected by automation; and (4) severance pay provisions.

These suggestions at best are only a beginning.

If the American people and their Government are prepared to accept the obligations of this philosophy, we have nothing to fear from the future of automation. If they fail to accept these obligations, the economy of the future cannot carry the weight of its own waste.

Both President Johnson and the Congress have already demonstrated a positive awareness of this challenge. They have recognized that the victims of technology must be retrained and absorbed into the economy. They have recognized that potential victims must be spared through foresight and planning. The very creation of the Commission is evidence of how clearly our political leadership understands that the benefits of mechanization must be used to enrich the lives of all—and not just a privileged few.

Perhaps the most useful contribution our union can make is to analyze the problem areas of our own "industry" and the implications, as we see them, of the ongoing mechanization of the U.S. Postal Service.

It can be argued that employees of the Post Office are not likely to suffer from automation.

This, to be sure, is the argument advanced by postal management, which tends to view its vast enterprise solely in terms of the labor-surplus problems associated with the advancing technologies of private industry.

Indeed, the Postmaster General may be technically correct—for the time being—when he says that "the development of mechanization is not designed to, nor will it, cause the loss of employment to regular employees."

The pledge has some persuasive quality against a background of increasing mail volume and increasing worker productivity on the one hand and decreasing cost factors and declining services on the other.

It is less persuasive when we discover that postal mechanization in 1965 is still in the swaddling clothes of earliest infancy.

It is not persuasive at all when we broaden our view to contemplate the staggering impact which automation already programed will inevitably have upon postal employees.

Since 1957 the Post Office—which bills itself as the biggest "business" in the world—has expended only $87,669,000 on mechanization—a mere drop in the bucket compared to the billions spent by private industry on automation and the research and development which undergirds it.

In fact the Post Office Research and Engineering establishment, which is responsible for developing all technological improvements, was not set up until 1958. It is only 7 years old.

As late as 1963 the total amount spent for development of mechanical equipment was only $224,000. But in the current fiscal year, budget requests for research and development funds shot upward to $13 million.

In other words, funds intended for developing new equipment have increased some 58 times over the amount spent just 3 years ago—a 5,800 percent increase.

Much has been done in this brief span—including the emergence of the ZIP code concept. But ZIP codes are far from being operational. Some ZIP code elements will go into effect in fiscal year 1966. But these will be procedural rather than mechanical, because the system cannot achieve the ultimate effectiveness claimed by its supporters until a time—still in the future—when virtually all the mail is sorted by electronic optical scanners.

Obviously mechanization of the Post Office is only just beginning.

Even at this early stage, however, it is evident that a revolution in mail handling has already been programed.

The coming optical scanners, in concert with letter sorting machines already in operation, are intended entirely to eliminate the human element from the mainstream of the mail flow system.

The combination of the two will be wonderful machines, indeed. They will have a design capability of reading ZIP codes and sorting letters to all States and 1,000 cities at a speed of 36,000 items per hour. The scanners will replace the manual keyboards on existing letter-sorting machines, thus eliminating all need for human operators.

The Post Office experts claim that ultimately something like 80 percent of all first-class mail will be handled by conveyor belts, facer-cancelling machines, presorting machines, optical scanners, sorting machines, tying machines, and other types of mechanical equipment needing only a minimum touch of human hands.

It may be useful to digress for a moment and consider both the existing new programed machines as well as a host of other laborsaving procedures introduced during just the past 2 years alone.

Prior to any actual sorting operations, raw mail must first be separated by physical characteristics for uniform handling. It must then be faced and cancelled.

Hoping to combine these processes into a single mail-flow system, the Post Office Department, during the past year, devised an experimental mail-preparation line. The collection mail starts at the beginning of the line and, with minimum manual assistance, diverts all odd mail which cannot be cancelled by machine and feeds the remainder into an automatic facer-canceller.

During a 5-day period this assembly line arrangement reportedly processed over 757,000 pieces of mail at an average rate of 27,250 pieces per hour. It will receive its first actual field tests during fiscal year 1966.

In this connection, the Department is also developing an electronic presorting device designed to scan letter mail at high speed and to separate those susceptible to automatic processing with only 5 percent margin of error. This presorter is now undergoing laboratory tests.

Meanwhile, 204 automatic facer-cancelling machines independent of the mail preparation line have already been installed in 72 post offices. On the basis of cost analysis reports, it is claimed they have yielded an annual return on investment of 46.8 percent. Annual savings in clerk hire formerly required to face this mail manually and to operate the old cancelling machines approximates $1.5 million, according to the Post Office.

The Department hopes to increase the efficiency of these machines by another 14 percent with a luminescent-sensing modification that will automatically separate airmail letters for preferential handling. A special luminous coating on airmail stamps will activate the machines. This, too, will be field tested in the fiscal year 1966.

A design for the first parcel-sorting system capable of sorting both to primary and secondary separations in a single operation has also been completed this year.

But perhaps the biggest breakthrough is the new letter-sorting machine mentioned earlier and proudly described by postal engineers as the world's finest machine of its kind.

With it, each of 12 operators can currently sort 60 letters per minute to 300 separations. Soon, with new automatic electronic ZIP code readers attached to these letter sorters, they will sort ZIP coded addresses at a speed of 36,000 per hour to 300 separations. The Postmaster General predicts even greater capabilities for the future.

Engineering specifications for the letter-sorter machine alone include 300 pages of text and parts lists and 1,900 drawings of parts and assemblies required to manufacture the machine. Also, there are 700 tool drawings for the use of bidders when estimates are made of special tool costs. The machine has 400,000 individual items compared to only 3,000 or 4,000 parts in an automobile.

Twenty-six letter sorters and 6 optical address reading machines are on order.

The first two new letter sorters off the assembly line are being installed at Philadelphia now. In November, two will be installed at Washington, D.C., and two more at Houston. In 1966, two machines will be installed in each of the following cities: Minneapolis, St. Paul, Portland, Seattle, San Francisco, Los Angeles, Boston, Buffalo, Louisville, and Miami.

Four of the address readers will be put on letter sorters at Detroit beginning in November, and two more will be installed at Buffalo a year after.

It should be noted, incidentally, that 42 of the existing multiposition letter-sorting machines are already operational, with 26 more on order. The letter-sorters in Detroit alone performed over 1 billion piece sorts in the past year, with a daily peak output of over 10 million individual sorts. Since their installation, the Detroit machines have processed over 3 billion piece sorts.

More than machines are involved in the radical laborsaving procedures introduced by the Post Office during the past 2 years. Following is a summary of these innovations:

1. Establishment of consolidated data centers: Beginning in April 1964, the 14 regional accounting offices were consolidated into 6 postal data centers where the use of electronic computers has, during the first year, effected an alleged $4 million reduction in labor costs.
2. Elimination of money order center: During 1964 the money order center at Kansas City was eliminated and operations centralized in Washington in cooperation with the Treasury Department with anticipated savings of $1 million in the first year.
3. Use of vehicles on city delivery routes: By using 11,500 three-wheeled vehicles in city delivery services, the Department claims savings of $4 million per year through enlargement of the carrier territories and reduction of driveout costs.
4. Reduction of parcel post service: On May 4, 1964, delivery of parcel post was restricted to a 5-day week basis.
5. Use of simplified postmark: Elimination of the hour of mailing in postmarks is supposed to save over $3 million during the coming year.
6. Precancelling of postal cards: Sale of precancelled postal cards, initiated in November 1962, eliminated the cancellation step in handling approximately one and a quarter billion postal cards per year.
7. Elimination of the postal savings system: Currently pending, the dismantling of this 50-year-old service involves dubious economies that are vigorously disputed by our union.

Finally, in a class all by itself, is the vaunted ZIP code system which is still far from being fully activated and whose ultimate impact upon jobs and labor staffing patterns cannot yet be estimated.

Already, however, the Post Office has started the process of closing down 70 so-called Gateway postal terminals throughout the Nation, including at least 12 in which widespread displacement and relocation of employees is certain. These terminals will be superceded by 533 sectional centers scattered according to population density and transportation facilities.

The Post Office claims that the new pattern of sectional centers will reduce normal handling of mail from 12 to 5 or 6 steps; yet there is already evidence in many local cases of mail having to be hauled miles out of its way under the new system.

Deeply intertwined with the new system is a collateral pattern of steady shrinkage in the enroute sorting of mail by mobile clerks with consequent dislocations and complex seniority problems.

Unanswered as yet because there has been no real field testing of the whole scheme is the larger question of what will happen to the workloads in major post offices affected by the new system and what it will do to the elaborate traceries of mail flow around the Nation.

In any case, despite the heady claims of superefficiency hopefully to be realized, the whole ZIP code system cannot be truly operative until optical scanners have been perfected and the automatic mail preparation lines have been installed in major post offices. In short, the system really depends upon full automation.

The foregoing review, we believe, clearly establishes the two points made at the outset: Postal mechanization and automation are still in their infancy, yet already the developments and innovations envisaged through technological change are literally staggering in their potential impact on the existing human skills and human resources of 585,000 postal employees.

Let us look finally at this human element in the Post Office—at the men and women whose specialized knowledge, without parallel in any other major industry, was basic to the successful processing of 72 billion pieces of mail in 1965.

This volume is rising at a steady rate. It will aggregate 90 billion pieces annually by 1970. It will surpass 120 billion pieces by 1980.

This onrushing tidal wave of mail gives comfort to those in the Post Office who argue that technology will never eliminate the need for at least the existing level of clerks, mailhandlers, and postmen. Indeed, they say, without technology our human resources will be inundated.

This viewpoint will bear some further scrutiny. It is all tied up with questions of human productivity; and with changing patterns of mail flow.

Productivity, as it is calculated by the Post Office, can be increased in several ways:

> It can be increased by reduction of services while assigning more manpower to moving the mail.
>
> It can be increased by speeding mail movements through improved organization and increased mechanization.
>
> It can be increased by squeezing more work out of the same number of employees through such devices as a work measurement system—a system, incidentally, still widely used in the postal service.

As a matter of fact, a combination of all these factors probably explains the recent rather impressive upward trend of postal productivity.

We estimate that the productivity of clerks and mail handlers in 1965 will rise 1.4 percent —as against only 1 percent in 1964 and 0.9 percent in 1963. Indeed, there has been a cumulative productivity increase of almost 5 percent during the past 4 years in striking contrast with a cumulative increase of only 1.1 percent during the previous 4-year period.

Comparing the two periods, it is evident that productivity of clerks and mailers—measured by the volume of mail handled per man-year—has increased almost 500 percent over the past 8 years. Moreover, the rate of annual increase since 1958 has achieved a pace that is more than 6 times what it was at the beginning of this period.

So, on the one hand, we find mail volume moving steadily upward at a rate of 3 to 4 percent a year and, on the other, we see individual productivity now surging up at a rate of almost 1½ per cent annually as against an annual growth rate only a few years ago of just better than a quarter of 1 percent. And this stepped up productivity has been achieved even before most of the vaunted automation has become effective.

It should be apparent from these facts that future productivity increases—both absolute and relative—ought to be sizable indeed, especially if the predicted efficiency of automated techniques is developed and sustained.

Even if we discount any phenomenal productivity acceleration and assume the rate of increase will not exceed a quarter of 1 percent annually, it will still require only 6 to 10 years for such increases to catch up to and surpass the annual growth rate of mail volume. And this assumes the present work force remains constant.

Parenthetically, we might observe that recently the Post Office, with unusual firmness, demanded of Congress—and got—an increase of 5,000 employees to help handle increased volume. In previous years it has asked for even more, but with only pro forma or routine enthusiasm.

In any case, our union believes as a matter of probability that productivity will continue to accelerate, spurred by the many technological programs in the offing, and that it will be a matter of only 3 or 4 years until productivity catches up with volume.

The U.S. Government then will face a basic manpower policy decision that goes right to the heart of the problem of automation.

It can phase out (to employ the official euphemism) x-number of employees as surplus —with skills that are useless in any other field of enterprise. Or it can restore the emphasis on service—an emphasis lacking since the early fifties—by diverting more manpower to a restoration and even a proliferation of postal services now unavailable or curtailed.

These options will bear further examination.

Our union believes management grossly oversimplifies the problem by swearing that no regular postal employee will lose his job because of automation.

It is clear that mechanization and all other mail flow improvements, including the sectional center and ZIP code concepts, primarily effects those employees concerned with mail handling and sorting—the one group most highly trained and most specialized, who constitute a large body of elite skills in a very real sense.

But, says management, there are only 64 or 65 post offices large enough to warrant the installation of sophisticated mechanization out of some 34,000 offices throughout the Nation; so the demand for skilled sorters and handlers cannot diminish all that much.

Yet these are precisely the 64 or 65 offices in which almost one half of the entire postal field service is employed to handle 70 percent of the mail volume. Out of a total of 584,990 employees in 1964, 252,222 were working in those 64 offices.

Estimating that 30 percent of the employees in a typical office are directly involved in the handling and sorting of mail, it is safe to estimate that a minimum of 75,000 postal clerks in those 64 offices will be directly and adversely affected by automated equipment now under development or already being tested.

Very well, we are told, there are still many other jobs available elsewhere in the service with no loss of seniority or status.

Even assuming, as we do not, that adequate jobs can be found somewhere in the postal service for all who are displaced by machines either through proliferation of services or otherwise, this "solution" takes no account of the dislocations involved.

To say that members of a skilled elite can be retrained for other jobs elsewhere is to argue that men and women at the top of their craft, with long careers behind them, are able and willing to undergo major adjustments that will substantially alter their status, location, and possibly their opportunity for advancement.

Perhaps this will happen in isolated cases; the possibility runs counter, however, to every known shred of psychological knowledge.

The fruit of this fallacy has already begun to fall. Opening of the new sectional centers this summer has caused major dislocations and hardships. In hundreds of cases, postal clerks whose jobs have been eliminated have been offered alternative positions hundreds of miles away.

From a management standpoint, the Post Office has indeed assured them of continued employment. But from a human standpoint, to accept this employment our clerks must uproot their homes, disrupt family and social ties, sell their property (at a loss in many instances), and incur many other tangible and intangible losses for which there is no compensation. It should be noted in this regard that the moving and related allowances offered these employees are totally inadequate.

Rather than break out of an established and comfortable economic and social environment, many employees may prefer to seek other employment—if such employment can indeed be found.

It is for these reasons that assurances by the Post Office Department must be tempered with a vast skepticism.

On this score, permit me to cite the views of the late John I. Snyder, Jr., one of the great pioneering industrial visionaries in the field of automation and, at the time of his untimely death, a distinguished member of the Commission.

Speaking to the AFL-CIO national convention in 1963, he called the idea that workers displaced by machines can be relocated with comparative ease a major "fallacy" and a "silly" one at that. He said:

> Workers who lose their jobs due to automation or anything else are usually those who are least able to move in the first place. They are generally the lower paid, the older, the unskilled workers who either cannot afford to move from an economic standpoint, or who are psychologically incapable of beginning a new life in a strange land.

As a matter of fact, Mr. Snyder also gave short shrift to the soothing notion that automation really isn't going to eliminate jobs. "I will stand," he said, "on the flat statement that automation is indeed eliminating jobs."

Whereupon he cited a long list of statistical evidence which he called "frightening figures."

He has testified, moreover, that most of his experience refuted "the dreamy fallacy [that] all of those nice people who lose their jobs to machines can be rapidly retrained and placed in other jobs requiring higher skills and paying more money." His statistics on this score are equally frightening.

Surely, then, a Government weighing its available options cannot in conscience settle only for budgetary expediency. For the test is not how cheaply we can handle and move the everincreasing volume of mail; but rather it is what effect change will have on the way people live, on their economic security, and on their ability to provide a decent education for their children.

In a broader sense the same principle applies. Machines will not buy back the products they produce; neither can jobless millions buy their yield. The edifice of mechanization and automation now abuilding must serve all. It has value only to the degree that it helps make possible a happier life and a more wholesome community. This holds true for the short run no less than the long run.

Benefits not shared in equal proportion among those who stand to lose as well as among those who stand to gain in the process of adjustment will not be benefits for long. They will be a curse.

We are entering a period unlike anything our predecessors have had to face. Most Americans are still babes in the woods as far as the cybernetics revolution is concerned. But a new age is already upon us. Automation in the years ahead will do away with most manual labor as we know it today. We are going to have to learn how to meet the challenge of that age, how to devise policies to cope with it, and how to take advantage of those machines. We must revise our old ways of thinking. We must accept the fact that muscle and brawn will be no match for circuitry and tubes. But above all, as Humpty Dumpty told the immortal Alice, "The question is which is to be master—that's all."

So what we say to management is simply this: We agree with you about the benefits that can come from automation. We welcome it. But when you dismantle the old system of productivity, you cannot discard your workers. They must not, by themselves, bear the costs of progress.

With particular reference to the welfare and interests of postal clerks, we believe it is essential that management enter immediately into effective prior joint consultations to allay the ill effects of automation.

Similarly, we believe that a comprehensive program of Federal legislation is necessary to protect the welfare of our members.

The essential elements of such a legislative program should include:

—reduction of working hours when necessary to maintain career employees at full employment;

—longer vacations, including periodic extended paid vacations;

—early retirement without loss of benefits;

—reduction of overtime;

—generous severance pay;

—realistic relocation and retraining allowances.

As the Ditchley Conference has pointed out:

> One of the major purposes of introducing technological change on a national level in the economy is to ensure growth, productivity, and an increasing standard of living. The government should be concerned that the economic growth and increased productivity which technological progress will bring about benefit not only the companies and the industries but that the benefits should be shared by the employees, the general economy, and the national population. For it is only through a fair distribution of the benefits of technological change that the continued improvement in the economy and the standard of living, which the nation is seeking for all, will be attained.

America needs the increased productivity that automation makes possible. We need it to upgrade the welfare of millions of American families, to open new vistas of leisure and culture, to provide public services consistent with shifting population patterns, to strengthen national defense, and to provide leadership and assistance for the peoples of developing and newly emerging nations.

Such goals demand creative planning and moral policies. For the mere emergence and development of automation carries with it no guarantee that it will be used well or wisely or that the benefits made possible will be shared by all. Men, not machines, must prevail. Our technology must not outrun our ethics. The enormous power of the cybernetic world must be the handmaiden of society, not its master.

STATEMENT

Prepared for the Commission
by the
United Mine Workers of America
Washington, D.C.

Statement by United Mine Workers of America

Automation—Promise and Problems

Introduction

If we were to rank the foremost problems of our age, automation would head the list. No other single problem looms so large in our national affairs and carries within it such a capacity for good and for evil.

Millions of Americans are directly affected today by the coming of automation. Other millions will feel its pressures in the years ahead. Indeed, automation amounts to no less than another industrial revolution, a change so radical that it can alter, in a permanent way, the social, political, and economic institutions of this Nation.

Nor does automation exist by and of itself. Rather, the decision to automate and the actual automating process is taking place within an environment of rapidly changing technology and greatly intensified national and international economic competition, and on a moral base which has undergone fundamental changes. The net result is a vacuum in our national life, a vacuum created by forces as of now beyond our comprehension. At the same time, automation has opened the door to vast new sources of wealth. To our generation has been given the tools to eliminate poverty in our Nation, to expand the material and spiritual values of all of our citizens, to conquer disease, and literally to reach for outer space. All of these things are possible today because of our new technology, because of the forces unlocked by our scientists and engineers.

On the other side of the ledger are millions of men left behind by the onrush of technology. Obsolete, too, are hundreds of communities all across this Nation which have been unable to adjust to the new age, whose industries have been outstripped by other methods of production, and which have fallen victims to changing times. Finally, there are the children, the young people who must face a tomorrow without hope, a tomorrow which will see them further and further behind a prosperous and growing America.

Always there is the speed at which change occurs. Speed is the hallmark of our present civilization. The new is rapidly rendered obsolete by the newer and today's advanced system is obsolete tomorrow. So rapid is such change that man cannot cope with it. Adjustments which were made in years must now be accomplished in weeks. Skills which once would last a lifetime are literally outdated overnight. It is a bewildering world, a world where order has given way to a frantic scramble to keep apace with the times. In one way or another all of us are affected and the course of our lives is permanently altered. We must meet the challenge of automation. We must understand its intricacies and unravel the complexities which arise in the normal course of the introduction and use of automation. We must bend this new and somewhat terrifying technology to the welfare of man.

It is against this background that we wish to discuss automation. We are seeking not only understanding, but also a plan of action, a plan which will permit a wise utilization of the new technology without the destruction of basic human values. We hope that this paper will serve that end. We also hope that the forces of labor, management, and government can be harnessed to meet effectively the challenges imposed upon our society by the onrush of technology. For in the final analysis, we must maintain those basic concepts of human dignity and individual worth in an era when science and technology seem to be assuming a dominant role in the operations of our society.

Basic Assumptions

Any study of automation, or of any subject of a technical nature, often flounders because it does not have a central theme, an objective. Therefore, to guard against this, we will set forth our basic assumptions and objectives in relation to which we shall discuss automation.

First, we believe that automation, or any other economic activity, is good only so long as it serves human welfare. Automation is not an end in itself. New technology of production, better products, lower prices, are not good per se. Rather, the objective of any economic activity must be the betterment of man. We become very indignant at those who substitute technical progress for human welfare. For what good is a better way to produce if there are no people to consume? What good will automation be if in the process human values are destroyed and people are reduced to ciphers in a larger and impersonal industrial machine?

We have an example of what can happen. In ancient Rome, the increasing wealth of large estates, made possible by slave labor, was paralleled by moral degeneration among the rest of the citizenry. Rome came to be a place where a once proud people lived only for bread and circuses and where the wealth of an empire was dissipated to satisfy the base urges of the mob. We must guard against this. We, as a nation, must never foresake our dedication to individual human welfare. It is true that times will change and new technologies will emerge. Yet, if our commitment to human values remains, if we are determined to maintain the core of our civilization—our people—we will continue to make progress in human as well as material values.

Second, automation is a national problem, a challenge for every person in the United States. We can, only at peril to ourselves and our children, write off the victims of automation as mere casualties of our system. To date we have done this. We have chosen to ignore those people displaced and relegate them to the backwaters of our American life.

Happily, this is changing. America is at long last coming to the realization that unemployment resulting from automation must be dealt with. Some consideration is being given to the victims of automation, to the men and women who have suffered much so that our Nation could progress. We applaud these efforts. But they are not enough. Men still live in fear of automation. Jobs are still lost without replacement as the onrush of technology accelerates.

We are familiar with the consequences. Thousands of coal miners were thrown out of work when mechanization was introduced into the mines. They were left to shift for themselves, with only their own resources and those of their union to protect them. Want and poverty came to Appalachia and has lingered for years because the Nation didn't care. Destitution has become commonplace in a land where plenty is the rule. We cannot permit this to happen again. We must, as a nation, acknowledge that because a national good accrues from automation, a national responsibility likewise rests with all of the American people to help the victims of technological displacement.

Third, adjustment to automation will not be simple and it will require the full cooperation of all segments of our society. It is easy to assume that all will be well if our Nation does nothing to assist in the transition to automation. It is argued that our own industrial revolution was accomplished without a great many programs to aid those displaced. It is also contended that we have benefited from industrialization, from the introduction of large industry and mass production.

This is true. But it is also true that many abuses occurred during our industrialization which would be intolerable today. Further, most of the abuses which confound the world today began with the evils of industrialization, evils with which the leaders of that time would not or could not cope. We are a mature economy and our people can no longer look to the frontier for the new and better life. Patterns of life are fixed, standards are set, and little, if any, deviation from such patterns and such standards is tolerable. Therefore, we as a people must not allow automation to work its will unhindered. Instead, we must plan for its introduction and learn to ease the transition from a nonautomated society to an automated one. We must care for the victims of change and strive to reintegrate them into society. Most importantly, we must constantly guard against the development of a "cultural lag," a gap between human values and technical progress. If this occurs, if technical skill outruns human adjustment to such skill, much of the good that can come from automation will be dissipated and major problems will arise to haunt us in the years and decades ahead.

We have therefore made three basic assumptions:

1. That human welfare is the objective of all economic activity, including automation.
2. Automation and the problems which arise from it are national in scope and character.
3. Positive action must be taken by our national leaders to help in the adjustment to an automated society.

The Forces Behind Automation

Automation in this country is the inevitable result of strong economic forces interacting under the discipline of free enterprise. Under our economic system it was nautral that a better way would be found to produce goods and services, and once discovered it would be speedily applied.

Nowhere is the truth more evident than in the bituminous coal industry of the United States. We should like to examine some of the events brought about by mechanization and automation in this industry because, first, coal is an industrial prototype of what can happen when an industry changes to automation, and secondly, all the benefits and all the woes of rapid technical progress are reflected in the bituminous coal industry.

Initially, it is necessary to discuss the economic background of technological change in the coal industry. Basically such change stemmed from two causes:

1. A market loss brought about by technical progress in the railroad industry and consumer preference for more convenient household fuels.
2. Increasing concentration of coal consumption in the electric utility market, forcing the coal industry to become extremely cost-conscious: The electric utilities purchase fuel almost entirely on a cost basis and a small differential in price is often the reason for success or failure in the market.

The market losses of coal are well known and need little elaboration. Oil and later natural gas made heavy inroads into coal's markets. The railroads, through dieselization, and the home heating market have largely disappeared as major coal outlets for coal. Technical innovation played a large role in these losses. The diesel engine is the result of many years of scientific and engineering research. Natural gas became available on a national basis only when the technology of long-distance pipelining was demonstrated. In any event, markets were lost to the coal industry. More importantly, these markets disappeared in a short span of time, a factor which is crucial to an understanding of the rapidity with which technological progress took hold in the industry.

Fortunately, with the decline in coal's markets in home heating and the railroads, another marketing avenue opened—the electric utility industry. But entry into the utility field presupposed an ability to meet stringent price competition. Indeed, we might say that coal's success in increasing its usage by the Nation's utilities is directly related to its record in reducing its delivered price. The declining price structure of bituminous coal was made possible by the increasing productivity of the coal miner through mechanization, a record which is unmatched by any other industry in this Nation. Output per man-day in the coal industry has jumped from 6.77 tons in 1950 to over 15 tons in 1964. Behind this record lies a virtual revolution in production, a revolution which transformed coal from a pick and shovel industry to one utilizing the most advanced machinery.

But there is another side to the story. In its struggle for survival, in its efforts to meet the stern test of competition, the coal industry threw thousands of men upon the industrial scrap heap. Much of this story is also known. The thousands of idle coal miners in Appalachia have received widespread attention and have been the object of many Government programs. However, in our opinion, too little attention has been given to the real cause of poverty and unemployment in coal mining—rapid and uncontrolled economic and technological change. This change swept away the patterns of a century in a few short years.

We cannot say that a shifting market pattern, with resultant mechanization, is the sole cause of worker displacement in the mining industry. Such a blanket statement would be a gross oversimplification of the facts. However, we believe that much of the misery which has come to coal mining areas could have been averted if an intelligent national policy on energy utilization were in effect. We contend that a more gradual shift to other fuels would have occurred and the frantic pace of mechanization would have been slowed somewhat.

The Impact of Automation on Coal

Automation in the coal industry has had two major results:

1. It displaced thousands of coal miners and replaced them with highly sophisticated machinery.
2. It changed coal mining from essentially a hand operation to a highly technical and complex mechine process.

Each of these changes has had an impact upon the social, economic, and political institutions of coal mining areas. Obviously, the displacement of so many men in such a brief span was a disaster to coal mining regions. In fact, so great was the shock that many of them have never recovered and some never will.

Adding to the overall distress of coal communities was the lack of other job opportunities there. Coal centers are notoriously dependent upon one industry, and with the decline in coal mining, there was a general economic decline. In addition, industries outside of coal areas, which were formerly sources of employment for ex-coal miners, were themselves automating and thus were unable to offer jobs in any number. Therefore, job displacement in coal mining was all too often permanent, and entire communities were rendered destitute by the twin forces of production technology and shifting market demands.

At the same time, the skill level required of a coal miner has increased at a rapid rate. The operation of mining machinery requires a great deal of experience and technical knowledge. The net effect has been to transform coal mining into a highly technical operation, an operation demanding highly trained workers with a variety of skills.

Some Implications of Coal's Experience

Coal's experience in the field of automation is not unique. Indeed, in one way or another we are seeing a similar pattern develop in many of our other industries and in communities across the Nation. Therefore, it might be well to draw some general conclusions from what has happened in coal so that we may use them as a base for further discussion in the general area of automation.

First, competition underlies all automation efforts. Companies automate to cut costs, improve quality, and make a better product. This is done under the stress of competition, or at least as a defensive measure against what competition might do. The tendency toward automation is especially noteworthy in those industries where foreign competition is an important factor and where foreign industries enjoy an advantage in the marketplace. It is well known that many industries, especially in Western Europe and Japan, have modern and efficient manufacturing plants. Many were built with American money after the war. These plants are often in direct competition with American industry. Such competition has forced upon our own companies the need for rapid automation, for speedy improvement in efficiency.

In addition, many foreign products are dumped in the United States. Such dumping destroys the price structure of competitive American industries and forces them to undertake efficiency programs on a massive scale. For example, in the coal industry there can be little doubt that residual oil importation hastened the mechanization process. Because residual oil is sold strictly on the basis of price, coal has had to meet that price or lose tonnage. To compete with a foreign product, waste product, the mining industry has had to push for maximum efficiency, which has often been obtained at the expense of human values.

In any event, it is clear that the greater the incidence of stringent competition, the more intensive will be the drive to automate.

Second, once begun, automation proceeds at a rapid pace. Improvement in productivity in coal mining has been going on for many, many years. Yet, once the intensive mechanization drive began, after 1950, the rate of improvement quickened perceptibly and tremendous advances were made.

The same situation is true in other segments of the economy. The trend toward automation is a rapid one and each company is engaged in a frenetic search for better ways to automate. Thus, the transition period is short and the ability of the Nation and its citizens to adjust is severely circumscribed.

This phenomenon is not new. All of the major changes which have occurred in economic activity have followed this pattern. In each case a rapid shift in traditional modes of operation took place, a shift which far outstripped the capacity of the population to adjust. This factor is perhaps the most crucial in dealing with the problems of automation. There can be little doubt of America's capacity to adjust to whatever change occurs. But such adjustments take time. If time is not available, social maladjustments will take place and people will suffer.

Third, reasonable adjustments to automation is dependent upon expanding markets.

Again, we might profit from the example of bituminous coal. In that industry the rapid introduction of new production technology was matched by an equally rapid deterioration of the market structure. The result was disaster in the employment sector. Each market loss was another stimulus for further improvement in productivity, with the resultant loss in manpower. The whole cycle of market decline-productivity improvement was repeated until coal's labor force plummeted to an all-time low.

This need not have happened. Steps could have been taken by the Federal Government to provide a semblance of order to the marketing structure of the coal industry. For example, Government agencies are themselves large consumers of coal. Such consumption is an important factor in certain segments of the coal industry, especially in those areas most affected by automation. It would seem logical that coal would continue to be used in Government installations to help ease the transition to automation. Unfortunately, such has not been the case. Many Government agencies have converted to other fuels and other agencies are rushing headlong to do so. Very often such conversions are made on the strength of dubious economic logic and without a true evaluation of all the facts involved. In any event, this Government policy has worsened the impact of automation on coal mining and made its transition period more difficult.

There are other examples of adverse governmental policies. Imported residual fuel oil has had an extremely detrimental effect upon employment in the coal industry. So, too, has the use of natural gas under utility boilers on an interruptible basis.

From all of these factors there is one generalization which can be drawn—automation can be accomplished with a minimum of adverse impact only within the context of expanding markets. If, on the other hand, automation takes place against a backdrop of declining markets, a crisis is certain to occur and major employment dislocations will take place.

Corrective Action

It is evident that steps must be taken to alleviate the impact of automation upon our work force. Unless this is done, much of the benefits flowing from the introduction of automated equipment will be lost and the forward sweep of automation blunted. We believe that automation is both necessary and inevitable. However, we feel that consideration must be given to the victims of automation and ways must be found to insure an orderly growth of the new technology.

We have listed below certain general areas where we feel effective action can be taken.

Economic Growth

Economic growth is of paramount importance. Without it there will be utter chaos in our society, as less and less people are required to turn out the goods and services required by our citizens. Further, we believe that such growth should be broadly based. Industrial development and the resultant job opportunities should not be confined to a few favored areas or a few favored industries. Economic opportunity should be made available to all citizens.

The Congress, through the Full Employment Act of 1946, is already committed to securing full employment in our land. This objective must be vigorously pursued and attained in our time.

New Technology

Our age is one of technology. We can reach the moon and probe the ocean depths. Even more startling developments are already on the drawing boards and the end is not in sight. This new technology can be put to use to create jobs. Indeed, the advances made by the application of scientific knowledge to resource development holds the key to the successful adjustment to automation.

For example, coal research can bring prosperity to the coal fields of this Nation. It can do so in a permanent way because it can create markets for coal and, perhaps importantly, permit the construction of industrial complexes in coal areas. The industries dependent upon coal as a raw material will provide employment for thousands of workers and economic progress for otherwise depressed regions.

Proof of the validity of this statement lies in the petrochemical industry. This industry has been built upon the availability of oil and the genius of American scientific effort. It has made possible the economic progress of entire sections of our Nation and the employment of thousands of our citizens. All of this progress is based upon resource development. The extraction of oil from the ground is merely the beginning. From this point the petroleum is processed and made into thousands of useful products, products which have a ready market in our Nation and the world.

Resource development is the traditional growth pattern of the American economy. We feel that it can be expanded upon and made to serve our national goals.

We believe that research and full employment are closely linked. This is especially true in the face of the billions of dollars spent each year by the Federal Government for research. We believe that Federal research efforts should be tied to the task of creating jobs. We further feel that Federal agencies engaged in or sponsoring research activities should be required to so schedule their programs that they will help to secure full employment in our land.

Education

In the final analysis, education will do a great deal to assist in the transition to automation. But education, like all other facets of our national life, will also have to adjust to the raw demands of the era. We must strengthen our school systems so that they may turn out students equipped to meet the challenges which will confront them. We must recruit and hold qualified and dedicated teachers, men and women who can provide our youths with the skills they will need and an insight into those values which have made our country great. This can be done only when we give our teachers the salaries that their profession deserves, and, more importantly, our recognition of the preeminent place which they should hold in our society.

We need more and better classrooms and facilities in all sections of the country. This is especially true in rural and depressed areas, where educational facilities are often woefully inadequate, where children cannot utilize their fullest talents in the educational process.

Higher education is becoming increasingly important. Our college graduates form a reservoir of talent which will serve our country in good stead in the years ahead. Unfortunately, many deserving youths for financial reasons cannot go to college. These young men and women represent a wasted resource, a potential which our Nation will never realize. We believe that higher education should be available to all those who can qualify. There should be a system of loans or grants to needy students which will permit them to go on to higher education.

But while we recognize the necessity for college education, we must also see the demand for skilled tradesmen. We require mechanics, electricians, etc. We will need them more in the future as our society increases in wealth and as mechanical and electrical equipment becomes more commonplace. Our education system must take this into account. We have vocational education in our high schools for those youths who will not go on to college, but who possess the talent to become skilled craftsmen. We should also have technical schools for high school graduates where they can be trained to improve their skills and acquire the latest techniques used in the industry. We cannot overemphasize the importance of such training. We believe it is sadly neglected at the present time. Unless corrective action is taken, the problem will become more and more acute in the future.

There are also many instances of high school graduates who do not possess the desire nor capacity for college education, nor the mechanical aptitude for the skilled trades. However, many of these youths without a formal college degree but equipped with business or professional training could meet a definite need. We are referring to a subcollege program aimed at providing training for young men and women which would enable them to enter the various facets of our national life better prepared to cope with its complexities There are many areas where this could be done. For example, a great deal of secretarial work is now performed by people with 2-year college or business school training. Many universities offer associate degrees in such fields as engineering, science, and business. Also, there is a great demand for medical and dental technicians, etc.

There should also be a link between classroom theory and industrial practice. Young people should, as a normal part of their training, be exposed to on-the-job conditions. They should see first-hand the demands which will be placed on them and the way in which an actual plant operates on a day-to-day basis. This familiarization process will serve two purposes. First, it will aid in the transition process between classroom and workplace. Second, it will provide a stimulus for the student because he will be able to see the value of his training at close range.

Finally, we believe that a continual upgrading of our work force should be made through periodic adult education. It is a known fact that no skill is immune from the inroads of automation. Further, technology is progressing so rapidly that few people are able to keep abreast of current condtions. Therefore, every worker who wishes to do so should be able to return to the classroom at definite intervals to upgrade his skills and to learn the latest techniques. We are suggesting that learning in the formal sense cannot stop with high school or technical school graduation. Rather, the stress of changing technology has made education a continual process, a necessary part of maintaining an adequate level of skill in a fast changing world.

Such adult education can be carried on in a number of ways. We will not presume to designate any one as ideal. However, we do feel that steps in this direction should be undertaken, and whatever has to be done to implement this should be done promptly.

Manpower Budgeting

One of the major problems in the field of automation is a lack of intelligent planning. Usually too little attention is given to the impact of the change upon the workers involved. As a result the transition to automation is abrupt with the dislocation of the work force. This does not have to be the case. Rational planning, which begins before the machines are introduced, can do much to allow an orderly shift in productive methods. Further, when planning does take place, much of the uncertainty and mystery of the change are eliminated and men can come to grips with the real problems involved rather than imaginary ones.

We believe that American industry can project its manpower requirements. We feel that a company executive can tell both the type and number of men he will need to operate for several years ahead. Our belief is substantiated by the long-range planning which is now commonplace in American industry. Capital outlays are budgeted years in advance.

Those engaged in research and development work look far beyond immediate markets in planning to meet the future. Marketing and distribution plans are carefully laid, often requiring months and even years for their fullest implementation. There are many other examples of such forward planning.

The same technique could be used to advantage in the manpower area. A company could easily define its future manpower needs. Once it had done this it would be in a position to prepare its work force for whatever changes would be necessary and to assist in lessening any unfavorable impact upon the individual workers in the plant.

Labor-Management Relations

The introduction of automated equipment has been a major source of acrimony between labor and management. However, this dissension does not have to exist. Both sides of the collective bargaining table share in the responsibility to aid those affected by a shift to automation in an industrial plant. Both will bear the harsh consequences which will inevitably follow serious dislocation of our labor force in the face of technical change. It must be clearly evident then that the continuation of our free economic and political institutions is dependent upon their ability to alter their operations to meet the press of new challenges.

In a sense, the mechanism of collective bargaining is ideally suited to cope with the dislocations of automation. Within the framework of labor-management discussions, much of the planning can take place to provide for human welfare in an environment of rapid progress. We do not mean to infer from this that labor-management discussions should be limited to collective bargaining sessions. The demands of the age are too great, the burdens too heavy for that. Instead, both labor and management should strive to meet, on a continuing basis, the demands of automation and to so order industrial activities that worker dislocation will be minimal. This is really the new challenge of the era for both labor and management. We hope that it will be effectively met.

Conclusion

The challenge of automation will not be fully met tomorrow or next year. The problem is too complex, the change too radical to speak of easy solutions. But, we can move ahead with programs that will bring the forces unleashed by automation under some sort of control. We can take steps which will protect the people most affected by automation and which will prepare those who are entering the labor force for a lifetime of service to the economy and the Nation.

We have outlined in this paper certain broad areas which we believe hold promise for effective action in meeting the awesome nature of the task before us. In so doing, we have not forgotten those programs already underway which also can make a tremendous contribution to the struggle and which can meet most effectively the immediate distress caused by automation.

To give an example, the United Mine Workers of America has consistently called for a strengthening of the unemployment compensation program. This program has been of tremendous value in meeting the distress caused by layoffs. It can continue to serve in this capacity for the victims of automation and can sustain them until other methods and other activities can give them permanent employment.

In the same manner, an improved social security program will do much to provide financial independence for our older population and permit many to leave the labor force, thus opening up jobs for younger men. We applaud the efforts of Congress in improving the social security program, especially with respect to the medicare provisions. We hope that an even greater liberalization of this program will be made, not only to aid in the struggle for rational adjustment to automation, but also because of the increasing needs of our retired citizens.

We also believe that a continuing study should be made into a shortening of the workweek. As productivity increases, the average length of the workweek will and should go down, thereby providing more job opportunities for all of our citizens.

However, the various programs now underway have not met our Nation's needs in the field of automation. Rather, what has been lacking is our national determination that the challenge must be met, that the transition will be made with a minimum of damage to the people involved. More importantly, we must constantly rededicate ourselves to the principles of the founding fathers, principles which are as valid today as they were two centuries ago, principles which placed the dignity of man above all other considerations. And by so doing, we are firmly convinced we can unravel the complexities of the technological revolution and channel the change into constructive paths —paths which will advance the stature and dignity of man.

STATEMENT

Prepared for the Commission
by the
Xerox Corporation
Rochester, New York

Statement by the Xerox Corporation

To take the five related "mandates" of the Commission in order, and attempt to make the most useful and pertinent comment possible on each, requires personal judgments which are necessarily suspect. The following is submitted subject to that caveat.

A. For most people, the past effects and the current and prospective role and pace of technological change can be made real only by rather startling examples. These may engage the attention and provide a measure of comprehension, but they lead nowhere in terms of prescribing useful action. Statements to the effect that the national debt, if paid in dollar bills laid end to end, will soon reach all the way to Mars, may engage the attention but they provide little guidance as to what to do about the national debt. Perhaps the best way to describe the past effects of technological change is to point to the present U.S. society and say, "There it is." It is difficult to find one single facet of this society which has been immune to the effects of technological change; but it is impossible to determine the extent to which technological change is responsible for each specific effect in conjunction with other forces. The precise degree and quality of any effect attributable to technological change cannot be separated out; and even if it could be, the information would be of limited value, because in some cases technological change serves as a catalyst, not participating in the reaction, but speeding it up; in other cases, technological change is itself catalyzed by political or social forces. It is much more important to know how technological change participates jointly and inextricably with the other forces which produce change in our society than to be able to assess the specific effects attributable to technological change; because from the former case we can predict to at least some degree and from the latter case we cannot.

The current role of technological change is that of catalyst to other changes (social, economic, political, philosophical); as instrument used deliberately to bring about such changes; and as part of an automatic feedback mechanism involving all these interrelated forces and operating at least partially outside the control of the society. Technological change is triggered deliberately to produce some effect which someone desires, but once triggered, it is involved in reactions of such complexity as to evade the complete control of the triggering agency.

The prospective role of technological change is that it becomes more controllable and hence more controlled because of iterative feedback with itself; that is, advancing technology is itself providing us with the mechanism for extending our control over advancing technology, via instrumentation and control systems and the related information systems whch can make such control effective, and via statistical models which permit us to make reasonably accurate predictions as to the effect of the interactions in which technology participates. This in turn means that the pace, as well as the effect, of technological change will become more predictable—and hence more controllable.

For the time being, however, both the role and the pace of technological change must continue to increase exponentially in the United States. This is because we are involved in an international situation in which we are numerically so inferior that only via a very rapidly increasing technological base can we hope to compete successfully for any length of time; and almost equally, because we have now structured a domestic situation in which the demands made upon technology are no less urgent and no less staggering than those imposed by the international situation; further, the technology required to satisfy our internal demands is increasingly less an offshoot or fallout from that required to meet our external demands. In the past, it has been true that almost all major developments in technology have resulted from military applications. This has caused technology to reach a threshold, or critical mass, such that relatively little fueling from such applications may be required to sustain an explosive growth rate; the feeling may be expected to come instead from the necessity of satisfying in at least some measure the exponentially increasing wants of an exponentially increasing world population.

B. Any such estimate must involve assumptions which should be noted if the estimate is to have any value. The basic assumption used here is that man-made impedances to technological change will delay but will be unable to halt such changes when they are clearly to the benefit of the total population. This implies that both government and industry will be increasingly responsive to the needs of those groups which would halt such change in the interest of serving their own short-sighted objectives. This is a large order, and can come about only in a world which has been further altered by technological and other forces. Without some such assumptions, however, nothing valid can be said about technological change: The society, if it chooses, can make it go negative as well as positive.

Assuming reasonable promotion of and receptivity to such change, the next 10 years will see an almost total change in the way in which goods are produced and in the employment pattern. Those industries which can be automatized efficiently will be; many of those which cannot be, will be replaced by or leap-frogged by competing industries which can be. Major job classifications involving almost any type of repetitive behavior capable of unambiguous description and response to stimuli will have been virtually eliminated (these will range from assembyline production to design engineering and routine clerical functions). Personal services will have increased greatly, as will other areas involving creativity, genuine decision making, and unique skills and capabilities. All significant production, including that of food, hardware, software, and ideas, will be achieved by a very small part of the total population. The rest will be engaged in distribution, in support activities, personal services, education, etc. At some point a majority of the population will be given more by the society then they contribute to it. Perhaps most important, the New England-Protestant ethic of the nobility of hard work and thrift will have begun to disappear[1] from the national consciousness; effective use of leisure time in terms of education, recreation, and, in particular, consumption, will be the new virtue; there may in many instances be little if any distinction made between work and work-related recreation.

The industries which will expand most are those related to very basic requirements: communications, information (including education), transportation, energy (including food and fuel), recreation, and distribution. The geographic areas most affected will likely be the megalopolis (from Boston to Norfolk), the Great Lakes area (Chicago eastward), Southern California, Texas (for at least the next 7 years), and Florida.

From almost every standpoint, but particularly from the employment standpoint, the most important single characteristic will be a broad background, flexibility, and adaptability. The most notable requirement for the citizen, as well as for the worker, will be that he possess an ability to learn and to adapt far beyond that expected of the current generation. Education may be expected to concentrate more upon teaching people how to learn and less upon detailed curriculums which are often obsolete before they can be taught. The requirement for adaptability to a world which we cannot foresee with clarity, even a decade ahead, will have profound impact upon the family, upon social structure, human values, and the community. We shall not be able to afford the inflexibilty of the last generation.

C. The greatest unmet community and human needs are for better education, better designed to prepare the individual to meet the challenges of a rapidly changing and unchartable future; and for adequate water, clean air to breathe, satisfactory motivation, and access to all the information required by the individual to fulfill his role in his own society and as a citizen of the world. On a broader basis, the challenge is for production and distribution of adequate food for not only the present world population, but for expanding that population until the entire earth is populated at a reasonable density. This involves populating those areas which are now deemed inhospitable: a formidable challenge for which technology is already adequate, but which will probably occur only as the result of increasing population pressure.

In none of these areas of great human need is technology the limitation. The limitation is rather in our ability to plan, to motivate, to manage, and to execute. We know how to clean up pollution of river and of atmosphere; how to educate; how to motivate; how to design information and transportation and distribution systems; how to grow food; how to make the desert bloom and the mountain habitable. Our failure to do these things is political, social, and managerial—not technological. We call upon our technology for only a small fraction of what it can deliver.

Federal Government R&D programs are taking the lead in solving all these problems. Federally supported R&D will continue to play a crucial role, but eventual solution of all these problems will depend upon the devising of better ways for governmental, industrial, and academic R&D to work together in closer teamwork which recognizes and exploits the strengths of each.

D. The channeling of new technology into a

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[1] In 1780 John Adams wrote to his wife, Abigail: "I must study politics and war, that my sons may have the liberty to study mathematics and philosophy in order to give their children a right to study painting, poetry, music, architecture, statuary, tapestry, and porcelain."

promising direction depends upon identifying a great human need, matching need with technology, planning, assessing risks against expected results, and finally executing a program, if the expectation is satisfactory. Civilian industry must, in our economy, measure the expectation in terms of financial profitability and return on investment; the Federal Government is able to think more in terms of human values, although the measures used must still relate to some form of profitability and return on investment, perhaps in terms of human rather than of financial values. The more responsible segment of industry, however, is willing to forego immediate profit in the interest of developing the capability to satisfy some major human need which offers the potential of eventual significant and profitable activity. It is in such areas that collaboration between private industry and government can be most fruitful: When government is interested in seeing a great human need satisfied; when industry is willing to operate on the basis of an enlightened and long-range viewpoint which says that the capability to satisfy any major human want must automatically imply good business opportunities; and where both are willing to define jointly objectives which reflect the essential mission of each.

In general, the great human problems of today cannot be solved either by industry or by government alone. Such problems are necessarily the preoccupation of government; but they are increasingly becoming the preoccupation also of private industry. The role of government is perhaps less in the solving of such problems than it is in identifying them and seeing to it that they are solved. When the solution involves new technology, then that part of private industry which possesses such technology should be involved, just as any other great national resource should be applied to appropriate problems.

E. The support and promotion of technological change in the interest of economic growth and improved well-being for the people depends upon determining the needs (many of them still latent) whose satisfaction will promote such well-being and fuel such growth. During the next decade, the list of obvious, basic needs may well become exhausted; the needs which must be addressed may become more sophisticated. Instead of water to drink, air to breathe, and food for the body, we should be concentrating more on providing more satisfactory transportation, energy, communications, and information—on education for the mind and motivation for the spirit—and perhaps on creating an environment in which education, work, recreation, and entertainment become less distinguishable.

The necessity for training people to be more adaptable has already been noted. Unless such adaptability is developed early, and reinforced through continuing education and training, there can be no solution to the problems posed by requirements for continual occupational adjustment and geographical mobility. In part, this will come about naturally through better education, better transportation, communication, and information; but in part it must be deliberately fostered and maintained. Measures taken to alleviate the results of attempting to force unadaptable people to adapt to new situations can only reduce the damage; they cannot prevent it.

It is to be expected that, in general, at the point at which a worker suffers technological unemployment, it is already too late to retrain him. There are exceptions, but they are not likely to be very significant. The ability to be retrained is the important thing—not the act of retraining—and that must be taught early. The concept that industry will require an increasingly small percentage of the total available output of all potential employees and cannot use those who do not meet minimal specifications at all, and that an increasingly large percentage of the society will receive more from it than they put into it, must be examined in terms of the alternative societies which are implied.

Appendix

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